Edited by Andreas Schroeter und Annemarie Käsbohrer

German Antimicrobial Resistance Situation in the Food Chain – DARLink

2009

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Imprint

BfR Wissenschaft

Published by A. Schroeter, A. Käsbohrer

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DARLink 2009

Federal Institute for Risk Assessment
Press Office
Max-Dohrn-Str. 8–10
10589 Berlin

Berlin 2013 (BfR-Wissenschaft 02/2013)
320 pages, 121 illustrations, 269 tables
€ 20,-

Cover Design: VK & K Werbeagentur GmbH & Co. KG
Printing: Format Druck und Medienservice GmbH

ISBN 3-938163-98-4
ISSN 1614-3795 (Print) 1614-3841 (Online)

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Please note, that in all tables decimal points are given by a comma (,) instead of a dot (.)

1 Abstract

The objective of this report is to give an overview of the results of resistance testing at the Federal Institute for Risk Assessment (BfR) in 2009. It comprises the results of the resistance testing of isolates submitted to the NRL for the conducting of analyses and tests for zoonoses (*Salmonella*) within the scope of diagnostics, as well as the results of the resistance testing of *Salmonella*, *Campylobacter*, verotoxin-forming *Escherichia* (*E.) coli* (VTEC), commensal *E. coli* and methicillin-resistant *Staphylococcus aureus* (MRSA) obtained within the scope of zoonosis monitoring in accordance with the general administrative regulation for zoonoses in the food chain and the control programmes in accordance with Reg. (EC) No. 2160/2003.

The broth microdilution method was used to examine all of the isolates for their susceptibility to a spectrum of antimicrobial substances harmonized on a European level. The determined minimum inhibitory concentrations (MIC) were evaluated based on “epidemiological cut-off values“. These values were taken from the Commission Decision 2007/407/EC as well as from publications of the European Committee on Antimicrobial Susceptibility Testing (EUCAST, www.eucast.org). These cut-off values make it possible to assess whether the isolates differ from wild-type populations of this pathogen with regard to their resistance, thus giving early evidence of resistance development.

A total of 3,200 *Salmonella enterica* ssp. *enterica* isolates from diagnostic submissions were included in the examinations. The majority of the isolates originated from animals (1,901; 59.4 %) and food (883; 27.6 %), although a considerable number of isolates from feeding stuffs (188; 5.9 %) and environmental specimens (228; 7.1 %) were also available. An additional 358 *Salmonella* isolates from animals and food were submitted and examined within the scope of zoonosis monitoring and *Salmonella* control programmes.

Among the diagnostic submissions, a total of 168 different *Salmonella* serovars were identified in accordance with Kauffmann-White-Le Minor, along with isolates for which complete serological typing could not be achieved. The serovars submitted most often were *S*. Typhimurium (24.3 % of all isolates), the monophasic variant of *S.* Typhimurium (*S.* 4,[5],12:i:-; 12.9 % of all isolates), and *S*. Enteritidis (10.6 % of all isolates). These serovars are also the most frequently detected serovars in human *Salmonella* infections throughout Germany and Europe. The trend of previous years continued in 2009 with the proportion of *S.* Typhimurium being further reduced in favour of its monophasic variant. An increase of *Salmonella* of the subspecies IIIb, which is common in reptiles, to 5.5 % of the examined isolates was remarkable. All other serovars and the isolates for which complete serological typing could not be achieved each made up a portion of 3 % or less of the total number of isolates examined.

Of the 3,200 diagnostic *Salmonella* isolates, 42.7 % were resistant to at least one and as many as 34.8 % to more than one substance class. Regarding the resistance situation for the single substances, the highest resistance rate of 32.3 % was observed once again in 2009 to sulfamethoxazole. Resistance rates of over 30 % of the isolates were also detected towards ampicillin (31.5 %), tetracycline (30.4 %) and streptomycin (30.1 %). This was attributable above all to the increase in the percentage of monophasic variants of *S*. Typhimurium, which almost exclusively showed this quadruple resistance. The rates of resistance to the other aminoglycosides (gentamicin and kanamycin) remained below 5 %. With 7.4 and 8.3 % respectively, the rates of resistance to nalidixic acid and ciprofloxacin were in a similar range as the average for the years 2000–2008. Several isolates (0.7 % and 0.6 %, respectively) with a resistance to one of the tested third generation cephalosporins (cefotaxime and ceftazidime) were again observed. Isolates from food had higher resistance rates for most antimicrobial substances in 2009 compared to the average values for isolates of all origins.

With the resistance rates of the most common serovars, significant differences were observed in the diagnostic isolates. Whereas with *S.* Typhimurium and its monophasic variants *S.* 4,[5],12:i:- as well as *S.* Paratyphi B dT+, *S.* Saintpaul and *S.* subspecies I rough, resistances to single antimicrobial substances as well as multiple resistances occurred very frequently (> 50 %), the vast majority (≥ 70 %) of the isolates of *S.* Agona, *S.* Dublin, *S.* Enteritidis, *S.* Livingstone, *S.* London, *S.* Mbandaka, *S.* Montevideo, *S.* Ohio, *S.* Senftenberg, *S.* Tennessee and isolates of the subspecies IIIa, IIIb and IV was susceptible to the tested active substance classes. Similar differences between the serovars were revealed with the isolates from zoonosis monitoring.

S. Typhimurium, the serovar that was submitted most frequently from animals, food and the environment within the scope of diagnostics, was resistant to at least one substance in almost 60 % of all cases. The resistance rate varied between 52 % and 77.8 %, depending on the origin. Most of the isolates were even resistant to more than one substance class (values between 42.7 % and 73.5 %), whereby resistances to sulfamethoxazole, tetracycline, streptomycin and ampicillin were detected most frequently.

Only a small proportion (4.4 %) of the diagnostic isolates of the monophasic variant *S.* 4,[5],12:i:-, which is closely related to *S.* Typhimurium, was susceptible to all tested active substances. In more than 90 % of the isolates, *S.* 4,[5],12:i:- showed resistance to streptomycin, ampicillin and sulfamethoxazole and to a slightly lesser extent to tetracycline (86.7 %).

Irrespective of their origin, more than 90 % of the *S*. Enteritidis isolates were susceptible to all tested active substances. Some isolates (approx. 0.6 %) showed resistance to more than one class of active substances. In the *S.* Enteritidis isolates, resistance to (fluoro)quinolones and ampicillin was observed almost exclusively.

The resistance situation of the 358 *Salmonella* isolates which were isolated and examined within the scope of zoonosis monitoring corresponded roughly with that of the diagnostic isolates. The significant differences between the isolates from herds of laying hens (7 % resistant) and broilers (52 % resistant) were particularly conspicuous. These differences also showed up in the analysis of the resistance data of commensal *E. coli* from the same sources (40 vs. 85 % resistant), but on a higher level. This underlines the necessity to make separate evaluations of the resistance situation for the two production types. The differences cannot be explicitly illustrated when the origins are summarised under the heading Chicken or *Gallus gallus*. The resistance situation in this main category is then determined essentially by the respective percentages of these two sources of origin.

Isolates from meat showed similar resistance patterns with the diagnostic isolates as well as those from zoonosis monitoring and accurately reflect the situation with the isolates from the herds of each species from which the meat was obtained. Accordingly, the resistance situation in *Salmonella* and *E. coli* from chicken meat is similar to that of the isolates from broiler flocks, with slightly lower resistance rates in the animals. It is known that infected broilers are a significant source of *Salmonella* on chicken meat. This applied similarly to pigs and pork and turkeys and turkey meat.

Similar resistance patterns as those for *Salmonella* from each different source were shown with the isolates of commensal *E.coli* that were available within the scope of zoonosis monitoring. In fact the resistance rates in *E. coli* were often higher than for the entirety of *Salmonella* isolates (e.g. 40 % vs. 7 % with the isolates of laying hens). Resistances of commensal *E. coli* are regarded as the mirror of selection pressure in each animal population. They are of particular interest for consumer health protection because they constitute a reservoir of resistance genes and/or resistance mechanisms which can be transferred to other bacteria, including pathogenic bacteria, in the course of horizontal gene transfer.

Particular importance is attached to fluoroquinolones and third and fourth generation cephalosporins as they have been classified by the WHO as “critically important antimicrobials” in human medicine.

Within the scope of the diagnostics, resistance to quinolones and fluoroquinolones was observed in isolates of different origins as well as in various serovars in different frequencies. They were less common (0.5 % and 1.1 %) in isolates from food than in those from the environment (8.3 and 10.1 %), those from animals (6.2 and 6.8 %) and above all those from food (11.2 and 12.6 %). Compared with the period 2000–2008, resistance rates have increased in most origins.

Resistance to quinolones and fluoroquinolones was observed in most of the 20 most common *Salmonella* serovars from the diagnostics. Very high resistance rates to ciprofloxacin were found with *S.* Paratyphi B dT+ (73 %) and *S.* Saintpaul (70.6 %). Fluorquinolone resistance was detected in particular with *Salmonella* and *E. coli* from poultry (broilers and turkey) and the meat thereof.

Since 2008, resistance to third generation cephalosporins has been tested with the substances cefotaxime and ceftazidime. While resistance rates were low with diagnostic *Salmonella* isolates as a whole compared with other substances, (0.7 % and 0.6 %), resistance rates significantly above average were recorded for several serovars and origins. Resistance to third generation cephalosporins was detected in *S*. Infantis (4.2 %), *S*. Saintpaul (2.6 %), *S*. Senftenberg (5.6 %), *S.* Typhimurium (0.4 %) and its monophasic variant from animals (1.9 %), as well as *S.* Paratyphi B dT+ (18.4 %) and *S*. Infantis (5.0 %) from food. It is conspicuous that, contrary to the previous year, in 2009 resistance of this kind was not detected in *S*. Saintpaul from food and *S.* Paratyphi B dT+ from animals.

Within the scope of zoonosis monitoring, resistance to third generation cephalosporins was detected in roughly 5 % of the *E. coli* and *Salmonella* isolates of broilers. Resistance was also found with *E. coli* and *Salmonella* from other poultry origins. Sporadically, resistance was also observed with commensal as well as verotoxin-forming *E. coli* isolates from veal calves and *E. coli* from pork.

Isolates of VTEC, which were available within the scope of the zoonosis monitoring of calves, as well as from veal and raw milk supplies, showed similar resistance patterns to commensal *E. coli* isolates from these populations. However, the overall resistance rates were lower.

When comparing the resistance situation of *Campylobacter* spp. from poultry and veal calves, a high level of resistance conformity was observed. While hardly any resistance to gentamicin, chloramphenicol and erythromycin was observed, resistance to (fluoro)quinolones, streptomycin and tetracycline was frequent. The rates of resistance to tetracycline and streptomycin were higher with calves than with poultry.

The resistance situation is of particular importance with poultry as *Campylobacter* has frequently been detected in poultry meat too, which means that it can find its way to the consumer. By contrast, *Campylobacter* is only seldom detected in veal.

The results of resistance testing and *spa* typing of MRSA from zoonosis monitoring 2009 and various other studies were described cohesively for the first time. A total of 1,182 isolates were examined, of which 1,179 were *spa* typable. Of the 946 isolates from zoonosis monitoring 2009, 89.2 % were categorised to the clonal complex CC398 associated with livestock on the basis of the determined *spa* types. The remaining isolates (10.8 %) belonged to *spa* types associated with other clonal complexes (non-CC398). The majority (45.9 %) of the isolates originate from the food chain turkey. Most of the non-CC398 isolates were obtained from turkey and chicken meat in the retail sector.

A total of 236 isolates tested for their resistance properties originate from other studies. In this way, 84 isolates from German breeding pig herds were obtained within the scope of an EU-wide baseline study (Decision 2008/55/EG) in 2008. In a national study conducted the same year on a voluntary basis, a further 152 MRSA isolates were obtained from fattening pig herds in Germany. Six of the isolates obtained from breeding pig herds belonged to the non-CC398 associated *spa* types. The isolates obtained from fattening pig herds all belonged to the CC398 type without exception.

When the resistance profiles of all *spa* typable isolates were viewed collectively (N=1.179) by epidemiologically cohesive groups (t011, t034, other CC398 and non-CC398), significant differences in the distribution of the resistance properties became apparent. Whereas almost a third (31.4 %) of the isolates of *spa* type t011 were resistant to a maximum of three active substance classes, this figure was less than a tenth (9.2%) with *spa* type t034. On the other hand, 84.9 % of the isolates of type t034 and 71.6 % of the isolates of other CC398-associated types were resistant to at least five active substance classes, as opposed to 52.5 % with type t011. Other clonal lines (non-CC398) showed a considerably higher percentage of resistance to more than six active substance classes (39.8%) compared to CC398-associated classes. The vast majority (86.1 %) of isolates of other clonal lines (non-CC398) were also resistant to the tested fluoroquinolone ciprofloxacin, as opposed to isolates of clonal line CC398 (< 21 %).

2 Introduction

2.1 Objective

This report gives an overview of the results of resistance testing by the National Reference Laboratory for the Conducting of Analyses and Tests for Zoonoses (*Salmonella*) (NRL Salm), the National Reference Laboratory Campylobacter (NRL Campy), the NRL for Coagulase Positive Staphylococci including *Staphylococcus aureus* (NRL Staph) and the National Reference Laboratory for Antimicrobial Resistance (NRL AR). The situation and development of the resistance of *Salmonella* are presented in a comprehensive manner for the second time on the basis of diagnostic isolates. The resistance data on *Salmonella* from diagnostic submissions are supplemented in this report to include the results of the resistance monitoring of zoonosis pathogens in the food chain in accordance with the General Administrative Regulation on zoonoses in the food chain (AVV Zoonosen Lebensmittelkette). This monitoring covers *Salmonella*, *Campylobacter*, verotoxin-forming *Escherichia coli* (VTEC), methicillin-resistant *Staphylococcus aureus* (MRSA) and commensal *E. coli.* The results of other studies were also taken into account for MRSA with the result that a complete overview of the resistance situation concerning MRSA in the food chain is now available for the first time.

The use of antimicrobially effective substances in veterinary medicine pursues the objective of curing sick animals and/or preventing the further spreading of infections in herds of livestock. In doing so, the related risks for human health must also be taken into account. These include above all the development and propagation of resistant bacteria strains and resistance determinants.

The monitoring of the resistance development pursues various objectives:

- The therapy of sick animals should be ensured by means of effective drugs. This therapy should be based on knowledge of the susceptibility of the causative agent to antimicrobial substances. For this reason, this susceptibility and the success of the therapy should be tested prior to application (Bundestierärztekammer 2010). As it is often not possible to await the laboratory test results, however, treatment is started in acute and severe infections before the test result is available. In this case, the test result can be used to support any change of therapy which may be necessary. The test result also provides important information on the general situation in the livestock herd and supports future therapeutic decisions.
- Monitoring of resistance in zoonotic pathogens and commensals serves mainly to protect consumers against resistant pathogens. In particular, resistance development trends and emerging resistances should be detected at an early stage. This is of special interest, as active substances of the same class or with the same mechanism of action are often used both in human and veterinary medicine. The emergence and spread of resistance to these antimicrobial substances in livestock production can impair or impede the therapy of human infections. Zoonotic pathogens, which can cause infections in humans, as well as so-called commensal microorganisms, which are actually harmless, can contribute to this spread of resistance. Like zoonotic pathogens, the latter can acquire resistance genes and transfer them to other bacteria which might be dangerous for humans.

Different assessment criteria are used to evaluate the susceptibility of the bacteria in these two different matters. When monitoring the effective treatment of infectious pathogens in animals, isolates from a clinical environment are observed and a **"clinical breakpoint"** determined for the pathogen and the indication is applied as the assessment criterion in. The goal here is to obtain a direct statement on the expected success of the treatment when the active substance is used on an infected animal. To monitor the resistance situation with respect to public health, on the other hand, zoonotic pathogens and commensals are observed and assessed and an **“epidemiological cut-off value”** used as the yardstick for evaluation. These cut-off values make it possible to assess whether the isolates differ from wild-type populations of each pathogen with regard to their antimicrobial resistance. Wild-type population are defined as strains with similar susceptibility and no evidence of an acquired resistance mechanism.

The objective of this second report is to continue with the overview of the results of resistance testing that was started in the first report and make them available to a wide readership. The results of ten years of resistance testing on diagnostic submissions of *Salmonella* at the Federal Institute for Risk Assessment (BfR) and its predecessor the Federal Institute for Consumer Health Protection and Veterinary Medicine (BgVV) are now available. The results of these tests were evaluated in a uniform manner on the basis of epidemiological cut-off values.

Extracts of the findings have already been published or reported in different ways, although different breakpoints were used in some cases. The aim is therefore to create reference documents to which interest groups and the BfR itself can refer in future reports and analyses.

2.2 Concept of antimicrobial resistance monitoring

In 2005, the BfR prepared a comprehensive concept for resistance monitoring which has been implemented step by step ever since. In the first step, isolates from three origins are to be included in the monitoring:

(1) representative isolates from food-producing animals
(2) representative isolates from food of animal origin
(3) clinical isolates from food-producing animals

These three pillars are then to be complemented in an expanded analysis to include isolates from the environment, from feeding stuffs and from food of plant origin.

The implementation of the monitoring programme is restricted due to the limited resources of the parties concerned and the extensive requirements regarding sampling and analysis.
The concept was implemented step by step for this reason:

- The diagnostic submissions from the regional laboratories were analysed in the first step. It should be noted here that the isolates are submitted for different reasons. It is to be expected that in particular *S*. Enteritidis and *S*. Typhimurium were submitted for phage typing on the one hand, while other isolates were sent in on account of difficulties with serotyping them.
- In the second step, baseline studies coordinated throughout the EU were conducted on the prevalence of *Salmonella*, *Campylobacter* and MRSA in Germany.
- To complement these, tests have been carried out on poultry since 2008 within the scope of *Salmonella* control programmes. These were expanded gradually to various poultry groups.
- The zoonosis random sampling plan has been prepared and zoonosis monitoring conducted on the basis of a national regulation on zoonoses in the food chain (AVV Zoonosen Lebensmittelkette) since 2009.

In order to utilise resources in the ideal manner, resistance monitoring has been closely linked with zoonosis monitoring since 2009. The isolates obtained in zoonosis monitoring are used by the BfR for the representative resistance monitoring of food-producing animals and food produced from them. Supplementary to this, clinical *Salmonella* isolates and those from *Salmonella* monitoring are used for resistance monitoring. The monitoring of various clinically relevant bacteria species from food-producing animals with a view towards therapy is conducted by the Federal Office of Consumer Protection and Food Safety (BVL) who report on this separately.

2.3 Concept of this report

The following results are presented in this second comprehensive report:

- those from the diagnostic submissions to the NRL Salm,
- from the submissions within the scope of the *Salmonella* control programmes for poultry,
- from zoonosis monitoring 2009 and
- from various studies on the incidence of MRSA.

This means that isolates from several sources were used for *Salmonella*. The various collection systems have advantages and disadvantages. The decisive advantage of isolates from zoonosis monitoring and the *Salmonella* control programmes is the methodically assured representativity of the sampling process which ensures that the examined isolates are representative of each origin. A further advantage of zoonosis monitoring is the clear definition of the origins in line with a prescribed system which increases the comparability of results. Due to the desired decrease in the prevalence of *Salmonella* in the course of the control measures, however, only a few isolates are available for resistance testing, depending on the matrix, so that a differentiated evaluation by serovars is only practicable to a limited extent. On top of this, the programmes in zoonosis monitoring change from year to year with the result that data on antimicrobial resistance are not available for every origin every year.

Data on a considerable number of isolates are usually provided every year by the diagnostic routine examinations of the NRL Salm, thus enabling annual evaluation, although the representativity of the examined isolates is not methodically assured. It can be assumed, however, that the examination methods have been relatively constant over the years and that the data from one year to another are comparable to a great extent. The information on origin is often less detailed than it is within the scope of resistance monitoring because the details of the submitter are less precise. Thus, for example, it is often the case that the isolates of chickens cannot be allocated to their respective production type (laying hens or broilers). The decisive advantage of data from diagnostics is that they have been collected continuously for years and are available every year.

The two collection systems complement each other in a practicable manner, thus producing a very precise image of the resistance situation with each pathogen from the food chain, especially *Salmonella*, when the results are viewed comprehensively.

The examination results presented here were acquired within the scope of the fulfilment of official duties and financed from BfR funds. Most of the examined isolates were placed at the disposal of the BfR by regional laboratories of the German federal states. The National Reference Laboratories at the BfR were responsible for the confirmation of the isolates and their microbiological characterisation. Practical resistance testing was carried out at the NRL for Anti-microbial Resistance and NRL Campylobacter, where the results were also evaluated.

The very good working relations with the regional laboratories and authorities of the German federal states, as well as with universities and private laboratories, have enabled this comprehensive collection of strains and data.

3 Material and Methods

3.1 Samples

3.1.1 Salmonella

Within the scope of diagnostics, a total of 3,200 *Salmonella* isolates from animals, food, feeding stuffs and the environment were submitted to the National Reference Laboratory for the conducting of analyses and testing for zoonoses (*Salmonella*) at the BfR (NRL Salm) in 2009. The isolates originated mainly from investigation facilities of the German federal states, as well as universities, zoological gardens and private submitters, and were not taken as part of a random sampling plan. Serological differentiation of all *Salmonella* isolates was performed in accordance with the White/Kauffmann/Le Minor schema (2007).

Within the scope of zoonosis monitoring in accordance with the general administrative regulation on zoonoses in the food chain (AVV Zoonosen Lebensmittelkette), 92 isolates from food were submitted from the investigation facilities of the German federal states and included in resistance testing. 266 isolates from the control programmes to be conducted with poultry throughout the EU were also available.

3.1.2 Campylobacter

Within the scope of zoonosis monitoring in accordance with *AVV Zoonosen Lebensmittelkette*, 258 *Campylobacter* isolates from animals and 206 isolates from food were passed on from the German federal states and included in resistance testing at the BfR.

3.1.3 E. coli

Within the scope of zoonosis monitoring in accordance with *AVV Zoonosen Lebensmittelkette*, 968 commensal *E. coli* isolates from animals and 494 isolates from food were passed on from the German federal states and included in resistance testing at the BfR.

3.1.4 Verotoxin-forming E. coli (VTEC)

Within the scope of zoonosis monitoring in accordance with *AVV Zoonosen Lebensmittelkette*, 81 VTEC isolates from animals and food were passed on from the German federal states and included in resistance testing at the BfR. 52 of them came from animals and 29 from food.

3.1.5 Methicillin-resistant Staphylococcus aureus (MRSA)

Within the scope of zoonosis monitoring in accordance with *AVV Zoonosen Lebensmittelkette*, 133 MRSA isolates from animals and 813 isolates that originated from food were included in resistance testing at the BfR. A further 236 isolates came from examinations of breeding and fattening pig herds.

All isolates were confirmed as MRSA at the NRL for Coagulase-Positive Staphylococcus including *Staphylococcus aureus* based on the PCR in line with Poulsen et al. (2003). *Spa* typing was done using the method developed by Shopsin et al. (1999). Categorisation of isolates to clonal complex CC398 was done by associating *spa* types with multilocus sequence types that belong to CC398. All other isolates were evaluated as non-CC398.

3.2 Categorisation of the isolates

Submission forms containing information that included the origin of the isolates were sent out along with the diagnostic *Salmonella* isolates. The isolates from zoonosis monitoring took into account isolates with which clear categorisation to one of the zoonosis monitoring programmes in 2009 was possible by means of the information that accompanied the sample. The procedure was as follows for the individual pathogens:

3.2.1 Salmonella

For this report, the diagnostic isolates which could be assigned to the main categories animals, food, feeding stuffs and the environment are included in the evaluation. These data are evaluated in the overview chapter (Chapter 4). In the special chapter on the isolates from animals (Chapter 5), the results have been evaluated in detail for the livestock species cattle, pig, chicken and turkey. With the food isolates (Chapter 6), the isolates from meat as a whole (all livestock species) as well as those acquired specifically from minced meat, as well as pork, chicken and turkey meat, have been evaluated. In the minced meat category, the isolates which could not be allocated directly to any livestock species were subtotalled.

Chapter 8 contains evaluations of isolates from the individual zoonosis monitoring programmes in 2009 which can be assigned to the main categories animals and food. Only isolates that could be assigned to one of the zoonosis monitoring programmes in 2009 were taken into account.

3.2.2 Campylobacter, E. coli and VTEC

Chapters 10–12 of this report contain evaluations of isolates from each of the zoonosis monitoring programmes in 2009 which can be allocated to the main categories animals and food. Only isolates with which clear categorisation to one of the zoonosis monitoring programmes in 2009 was possible by means of the slip that accompanied the sample were taken into account.

3.2.3 MRSA

This report contains evaluations of isolates which could be allocated to the main categories animals and food.

The evaluation in Chapter 13 includes all isolates assigned to one of the zoonosis monitoring programmes in 2009 on the submission form. In Chapter 14, the isolates from the dust samples from herds of breeding pigs and fattening pigs respectively that were taken within the scope of the EU baseline study (Decision 2008/55/EC) are observed separately.

Overall, the resistance situation for 2009 and the entire ten-year period from 2000 to 2009 is presented, the latter only for *Salmonella* in order to identify possible development trends.

3.3 Determination of the minimum inhibitory concentration

The minimum inhibitory concentration (MIC) was determined by the broth microdilution method (CLSI 2009). To do so, ready-to-use microtiter plates (TREK Diagnostics Ltd., UK) were used which differ in the layout for *Salmonella/E. coli/VTEC*, *Campylobacter* and MRSA. Plate format EUMVS (Tab. 3.1) was used for the *Salmonella/E.coli*, EUCAMP (Tab 3.2) for *Campylobacter* and NLM4 (Tab. 3.3) for MRSA. Apart from the MRSA, the other two plate formats are coordinated on EU level as far as the antimicrobial substances to be tested and their concentration ranges are concerned.

Dispensing, incubation and reading of the microtiter plates, as well as compliance with the quality standards, were performed in accordance with CLSI guidelines (M07-A8) and information from TREK Diagnostics Ltd. The *Escherichia coli* strains ATCC 25922 and ATCC 35218 were used as reference strains for *Salmonella/E.coli*, *Campylobacter jejuni* ATCC 33560 for *Campylobacter* and *Staphylococcus aureus* ATCC 29213 for MRSA.

3.4 Evaluation of the minimum inhibitory concentration

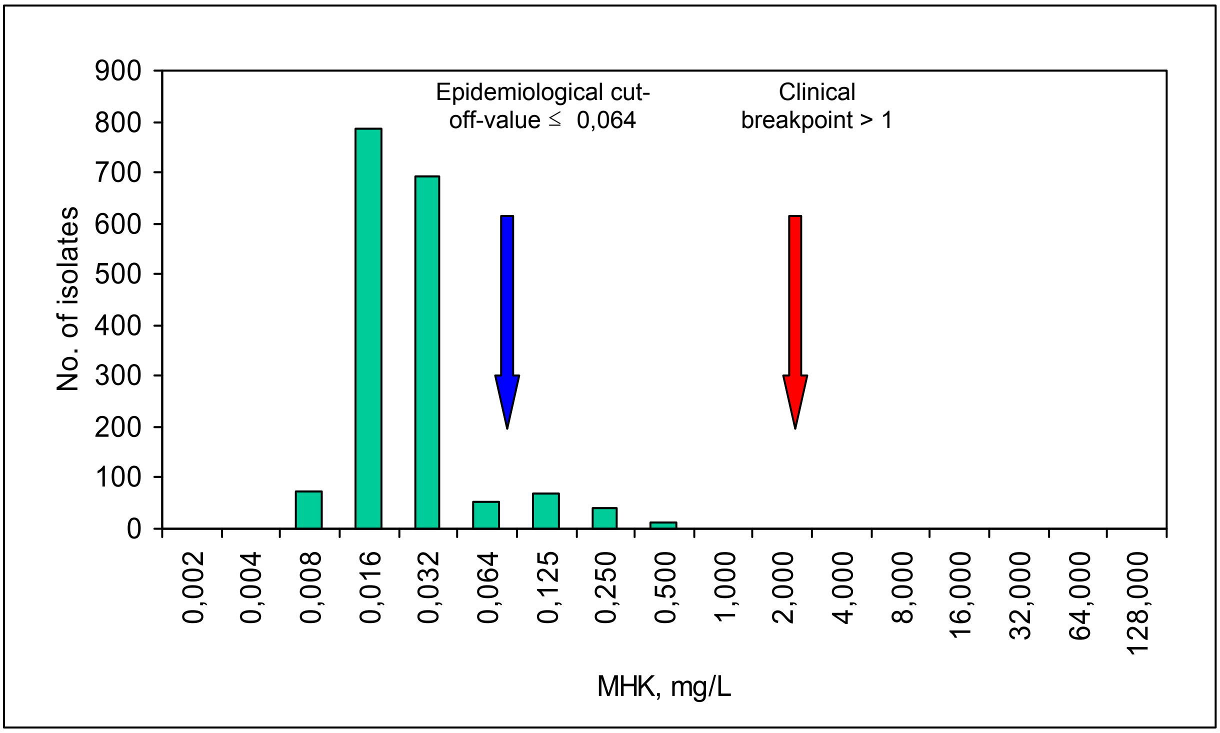
The results for *Salmonella* and *E.coli* were evaluated on the basis of the cut-off values established in Decision 2007/407/EC. Decision 2007/507/EC formed the basis for the evaluation of *Campylobacter*. The epidemiological cut-off values established in www.eucast.org were used for MRSA and those for *S. aureus* where no values were available. The relevant recommendations of the European Food Safety Authority (EFSA) were also included for all microorganisms. Where no cut-off values were set for a tested active substance in the Commission decisions, the epidemiological cut-off values defined by EUCAST (www.eucast.org) were used. No epidemiological cut-off value for *Salmonella* spp. was available for kanamycin. In this case, the epidemiological cut-off value for *Escherichia coli* was used.

The principle of epidemiologic cut-off values is based on the assumption that in each bacterial species there is a wild-type population without any acquired resistance mechanisms (to an antimicrobial substance). The epidemiological cut-off value is therefore distinguished from the clinical breakpoint, which relates directly to the possible treatability of the pathogen and therefore takes into account pharmacodynamic and pharmakokinetic aspects, as well as specific characteristics of the host and target organs. The advantage of the epidemiological cut-off value is its higher sensitivity towards a possible resistance development. Every MIC value above the cut-off value indicates resistance development, even if this is not yet necessarily associated with direct consequences on the treatability of an infection. In contrast, the clinical breakpoint only classifies a pathogen as resistant if effective treatment of an infection becomes unlikely due to an elevated MIC value.

Using the example of the fluoroquinolone ciprofloxacin, figure 3.1 shows the difference between the epidemiological cut-off value and the clinical breakpoint. The MIC value distribution of the isolates often shows two peaks. The left peak represents the pathogen's wild-type population (here: *Salmonella* spp.). The epidemiologic cut-off value is set at the concentration where this peak ends (in this case at a value of 0.064 mg/l). Isolates with MIC values above the epidemiological cut-off value differ from the pathogen's wild-type population and therefore have to be rated as resistant (www.eucast.org).

The clinical breakpoint is set on the basis of complex considerations which focus on the treatability of infections. The clinical breakpoint is often significantly above the epidemiological cut-off value. Effective treatment of infections caused by pathogens with MIC values above this breakpoint is usually no longer possible with this particular active substance.

Fig. 3.1: Epidemiological cut-off value and clinical breakpoint for ciprofloxacin in *Salmonella* spp. (www.eucast.org)



Tab. 3.1: Antimicrobial substances used, test ranges and evaluation criteria for *Salmonella/E. coli* in 2009 (As of 17.05.2010)

Antimicrobial class	Antimicrobial substance	Epidemiological cut-off value ≤	Test range		Evaluation criteria
			Minimum	Maximum	
		mg/L	mg/L	mg/L	
Aminoglycosides	Gentamicin	2	0,25	32	2007/407/EC
	Kanamycin	8	4	128	EUCAST[1]
	Streptomycin	32*/16**	2	128	2007/407/EC
Amphenicoles	Chloramphenicol	16	2	64	2007/407/EC
	Florfenicol	16	2	64	EUCAST
Cephalosporins	Cefotaxime	0,5*/0,25**	0,06	4	2007/407/EC
	Ceftazidime	2/0,5**	0,25	16	EUCAST
(Fluoro-)quinolones	Nalidixic acid	16	4	64	2007/407/EC
	Ciprofloxacin	0,06*/0,03**	0,008	8	2007/407/EC
Aminopenicillins	Ampicillin	4/8	0,5	32	2007/407/EC
Polymyxins	Colistin	2	8	16	EUCAST
Folatsynthesis - inhibitors	Sulfamethoxazole	256	8	1024	2007/407/EC
	Trimethoprim	2	0,5	32	2007/407/EC
Tetracyclines	Tetracycline	8	1	64	2007/407/EC

[1] No epidemiological cut-off value for *Salmonella* spp. defined by EUCAST (17.05.2010). Instead, the epidemiological cut-off value for *Escherichia coli* was used. * Value for *Salmonella* spp. ** Value for *E. coli*

Tab. 3.2: Antimicrobial substances used, test ranges and evaluation criteria for *Campylobacter* (As of 17.05.2010)

Antimicrobial class	Antimicrobial substance	Epidemiological cut-off value ≤	Test range		Evaluation criteria
			Minimum	Maximum	
		mg/L	mg/L	mg/L	
Aminoglycosides	Gentamicin	1*/2**	0,12	16	2007/516/EC
	Streptomycin	2*/4**	1	16	2007/516/EC
Amphenicoles	Chloramphenicol	16*/**	2	32	EUCAST
(Fluoro-)quinolones	Nalidixic acid	16*/32**	2	64	EUCAST
	Ciprofloxacin	1*/**	0,06	4	2007/516/EC
Makrolide	Erythromycin	4*/16**	0,5	32	2007/516/EC
Tetracyclines	Tetracycline	2*/**	0,25	16	2007/516/EC

* *C. jejuni*
** *C. coli*

Tab. 3.3: Antimicrobial substances used, test ranges and evaluation criteria for MRSA (as of 17.05.2010)

Antimicrobial class	Antimicrobial substance	Epidemiological cut-off value ≤	Test range		Evaluation criteria
			Minimum	Maximum	
		mg/L	mg/L	mg/L	
Aminoglycosides	Gentamicin	2	0,5	64	EUCAST
	Kanamycin	8	8	128	EUCAST
Amphenicoles	Chloramphenicol	16	2	256	EUCAST
(Fluoro-)quinolones	Ciprofloxacin	1	0,5	64	EUCAST
Isoxazolylpenicillins	Oxacillin	2	0,5	8	EUCAST
Folatsynthesis - inhibitors	Trimethoprim/ Sulfamethoxazol	0,5	0,25/4,8	16/304	EUCAST
Tetracyclines	Tetracycline	1	1	64	EUCAST
Lincosamides	Clindamycin	0,25	0,25	32	EUCAST
Macrolides	Erythromycin	1	0,12	16	EUCAST
Pseudomonic acids	Mupirocin	1	1	16	EUCAST
Oxazolidinones	Linezolid	4	1	16	EUCAST
Streptogramines	Quinupristin/ Dalfopristin	1	0,5	8	EUCAST
Glykopeptides	Vancomycin	2	2	32	EUCAST

3.5 Definitions

An isolate was characterised as susceptible if its minimum inhibitory concentration (MIC) was less than or equal to the applied epidemiological cut-off value.

An isolate was characterised as resistant if its minimum inhibitory concentration (MIC) was greater than the applied epidemiological cut-off value (microbiological resistance).

An isolate was characterised as multiresistant if it was resistant to more than one substance class.

4 On the antimicrobial resistance situation of *Salmonella* isolates from diagnostic submissions

4.1 Overview of investigated isolates

4.1.1 Total serovars

As an introduction, a general overview of the available isolates from diagnostic submissions is presented. A total of 3,200 *Salmonella* isolates from diagnostic submissions were tested for resistance to antimicrobials in 2009. The results were compared with those from the period 2000–2008. For further analysis, the isolates were classified into the categories environment, feeding stuffs, animals and food in accordance with the information provided by the submitters.

As in previous years, the main proportion of the isolates originated from animals (1,901; 59.4%), followed by isolates from food (883; 27.6 %). A considerable number of isolates from feeding stuffs (188; 5.9 %) and environmental specimens (228; 7.1 %) were also available for testing (Tab. 4.1.). Additional details are listed in the appendix in Table 20.1.

A total of 168 different serovars were identified along with some types for which complete serological typing was not possible. Table 4.1 shows the 20 most common serovars in the environment, feeding stuffs, animals and food respectively, as well as in the total collective.

The serovars tested most often for resistance were *S*. Typhimurium (24.3 % of all isolates), the monophasic variant of *S*. Typhimurium (*S.* 4,[5],12:i:-) (12.9 %) and *S*. Enteritidis (10.6 % of all isolates). These two serovars were also the most frequently detected serovars in human *Salmonella* infections throughout Germany (RKI, 2010) and Europe (EFSA, 2011). There was a remarkable increase in *Salmonella* of the subspecies IIIb to as much as 5.5 % of the investigated isolates. In the period 2000–2008, this subspecies made up only 1.8 % of all isolates. All other serovars or types represented a proportion of maximum 3 % each of all examined isolates.

The individual serovars occurred with varying frequency in animals, food, feeding stuffs and the environment. Figure 4.1 shows the ten most frequent serovars in the total collection and summarises the percentage of other serovars in the group “other serovars” by group of origin. This group made up 20 to 30 % of the isolates from the environment, animals and food, while it accounted for 68 % of the isolates from feeding stuffs. This emphasises the great diversity of the isolates available from feeding stuffs and the environment. The similarity between the environmental and animal isolates suggests that the environmental isolates were obtained mainly from the vicinity of livestock farms.

Figure 4.2 shows the percentage of the ten most common serovars in the total collective along with their percentages in the individual years. The trend of the previous years continued in 2009 with the percentage of *S.* Typhimurium reducing further in favour of its monophasic variant (Tab. 20.2).

Because the extent of the resistance depends on the serovar and on the origin of the isolate, the occurrence of the most common serovars is also analysed separately below for the different origins.

Tab. 4.1: Share of the 20 most frequent serovars in the four major source groups environment, feeding stuffs, animals and in the total of all diagnostic isolates (2009)

Serovar	Proportion	(%) of all isolates by origin				
Origin	Total	Total	Environment	Feedingstuffs	Animals	Food
Number of isolates	3.200	3.200	228	188	1.901	883
***S.* Typhimurium**	777	24,3	30,3	9,0	26,6	21,0
***S.* 4,[5],12:i:-**	412	12,9	10,1	10,1	11,2	17,9
***S.* Enteritidis**	340	10,6	9,6	0,5	11,2	11,9
***S.* Subspec. IIIb**	176	5,5	0,4	0,0	9,2	0,0
***S.* Subspec. I rough**	87	2,7	3,5	2,1	2,2	3,7
***S.* Derby**	83	2,6	2,2	0,5	1,3	5,9
***S.* Infantis**	80	2,5	4,8	2,7	1,3	4,5
***S.* Senftenberg**	75	2,3	3,1	6,9	0,9	4,2
***S.* Saintpaul**	68	2,1	1,3	0,0	2,1	2,9
***S.* Paratyphi B dT+**	63	2,0	3,9	0,0	0,8	4,3
***S.* Subspec. IV**	62	1,9	0,0	0,0	3,3	0,0
***S.* Dublin**	52	1,6	0,0	0,0	2,2	1,2
***S.* Livingstone**	49	1,5	4,8	6,4	0,9	0,9
***S.* Subspec. IIIa**	49	1,5	0,0	0,0	2,6	0,0
***S.* Newport**	40	1,3	0,4	0,0	0,7	2,8
***S.* Anatum**	38	1,2	4,4	2,1	0,7	1,1
***S.* Ohio**	35	1,1	0,9	5,9	0,7	1,0
***S.* Mbandaka**	34	1,1	1,8	2,7	1,1	0,6
***S.* London**	28	0,9	0,4	1,6	0,7	1,2
***S.* Montevideo**	28	0,9	2,2	5,3	0,7	0,0
***S.* Indiana**	28	0,9	1,3	0,0	0,8	1,0
***S.* Tennessee**	28	0,9	1,3	3,7	0,9	0,1
***S.* Subspec. II**	24	0,8	0,0	0,0	1,1	0,3
***S.* Brandenburg**	22	0,7	0,4	1,6	0,5	1,0
***S.* Virchow**	22	0,7	0,0	0,5	0,8	0,6
***S.* 4,12:d:-**	19	0,6	0,4	1,1	0,4	0,9
***S.* Kottbus**	17	0,5	1,8	0,0	0,5	0,5
***S.* Kisarawe**	17	0,5	0,0	0,0	0,8	0,1
***S.* Hadar**	14	0,4	0,0	0,5	0,2	1,0
***S.* Havana**	13	0,4	0,0	3,2	0,3	0,1
***S.* Agona**	12	0,4	0,4	2,7	0,1	0,6
***S.* of group C1**	12	0,4	0,9	0,0	0,5	0,1
***S.* Bovismorbificans**	11	0,3	0,4	0,0	0,2	0,8
***S.* Cerro**	9	0,3	0,0	2,1	0,1	0,5
***S.* Schwarzengrund**	9	0,3	1,3	1,6	0,1	0,1
***S.* Monschaui**	8	0,3	0,9	0,0	0,3	0,0
***S.* Falkensee**	7	0,2	0,0	3,7	0,0	0,0
***S.* Give**	7	0,2	0,9	0,5	0,1	0,2
***S.* Orion**	6	0,2	0,4	2,1	0,0	0,1
***S.* Idikan**	3	0,1	0,0	1,6	0,0	0,0
Other serovars	336	10,5	5,3	19,1	12,0	6,7

Yellow background: Top 20 of the respective category

Fig. 4.1: Proportion of the ten most frequent serovars among the isolates from the environment, feeding stuffs, animals, food and all sources (2009)

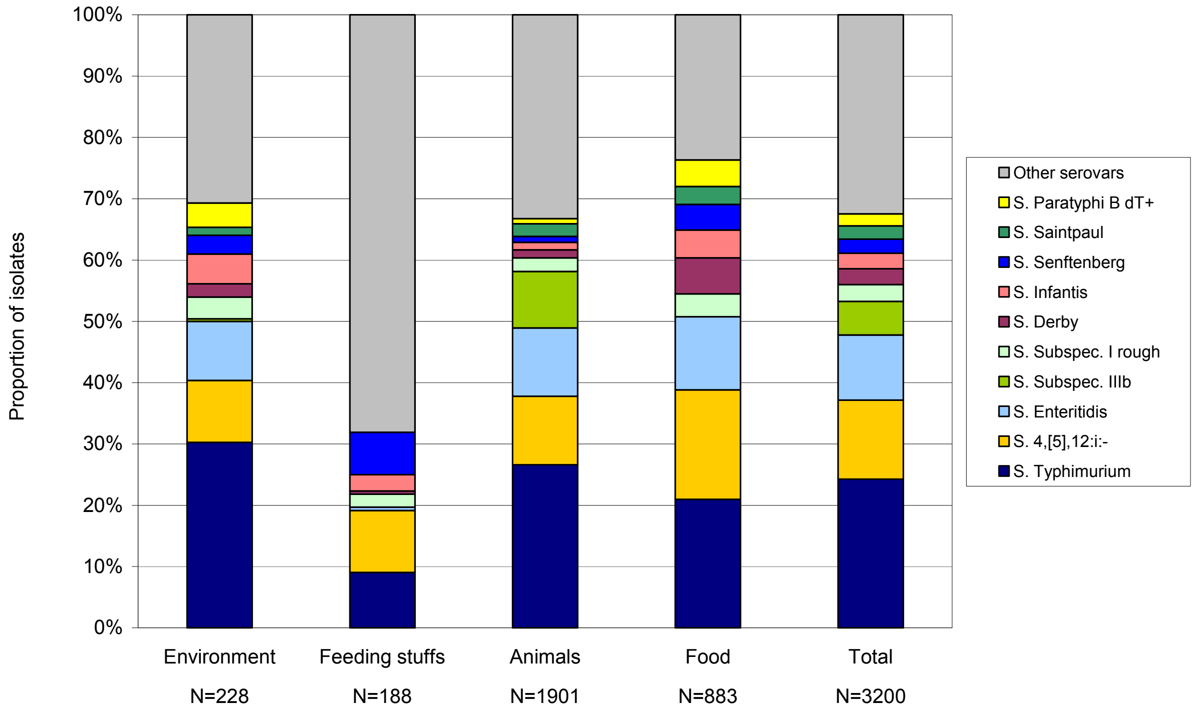
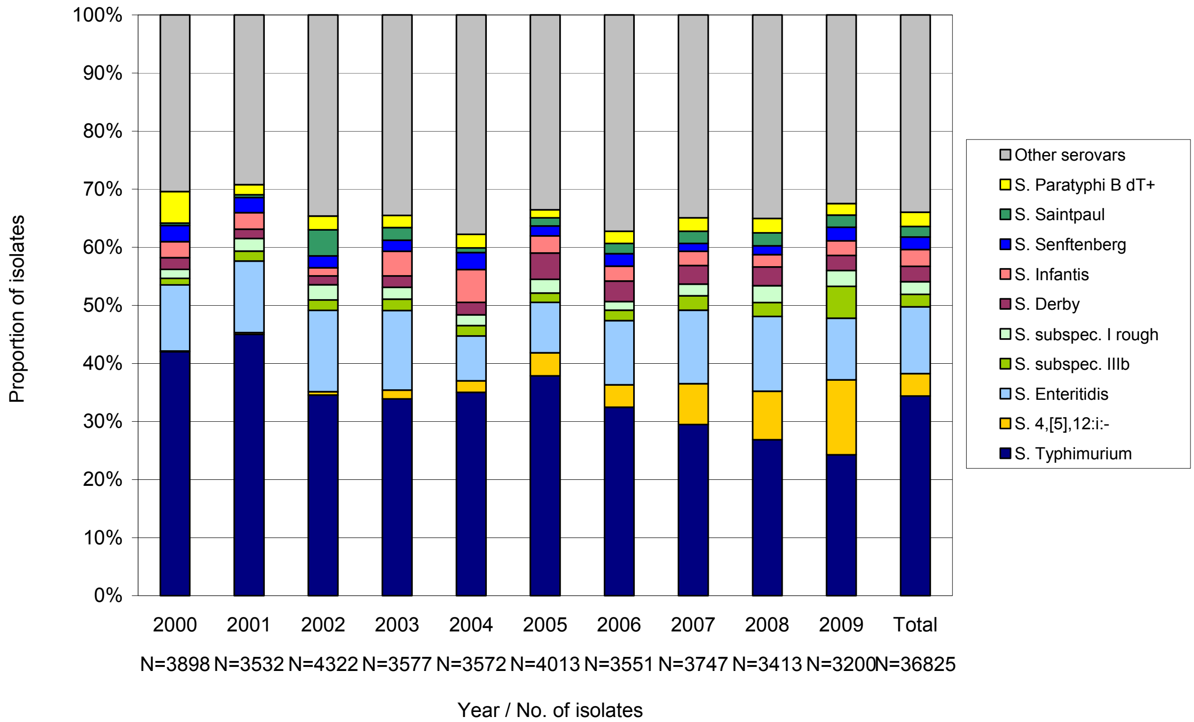


Fig. 4.2: Proportions of the ten most frequent serovars among all isolates from all sources (2000–2009)



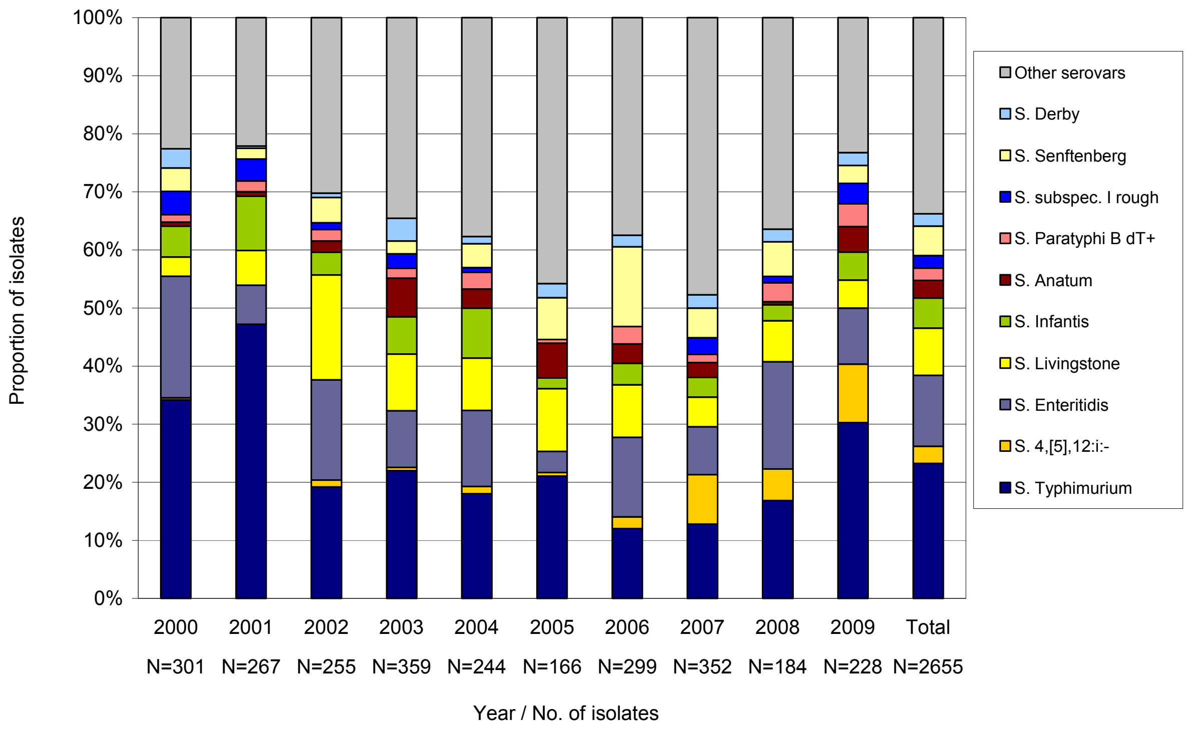
4.1.2 Serovars from environmental samples

A total of 228 isolates from environmental samples were typed in 2009. The most common serovars were *S.* Typhimurium (30.3 %), the monophasic variant of *S.* Typhimurium (*S.* 4,[5],12:i:-) (10.1 %) and *S.* Enteritidis (9.6 %), followed by *S.* Livingstone (4.8 %) and *S.* Infantis (4.8 %) (Tab. 4.1). Seventeen of the 20 most common serovars in the total collective each accounted for at least 1 % of the isolates from environmental samples. Almost 10 % of all isolates from the environment did not belong to any of the 20 most common serovars of the total collective.

In addition to the 20 most common serovars in the total collective, the 20 most common serovars from environmental samples are listed in Table 4.1. On top of the most common serovars from the total collective, *S.* Kottbus, *Salmonella* of the group C1, *S.* Schwarzengrund, *S.* Monschaui and *S.* Give were among the 20 most common isolates from environmental samples with a percentage of 0.9 % to 1.8 % in environmental samples.

The distribution of the most common serovars from environmental samples in the period 2000–2009 is shown in Figure 4.3. Additional detailed data is listed in Table 20.3 in the appendix. The significant increase in *S.* Typhimurium and its monophasic variant (*S.* 4,[5],12:i:-) compared with the previous year is conspicuous, whereas the percentage of *S.* Enteritidis was significantly lower than the previous year. There was a distinct reduction in 2009 in the proportion of other serovars with *Salmonella* isolates from environmental samples. More than 75 % of the isolates belonged to the ten most common serovars.

Fig. 4.3: Proportions of the ten most frequent serovars among isolates from the environment (2000–2009)



4.1.3 Serovars from feeding stuffs

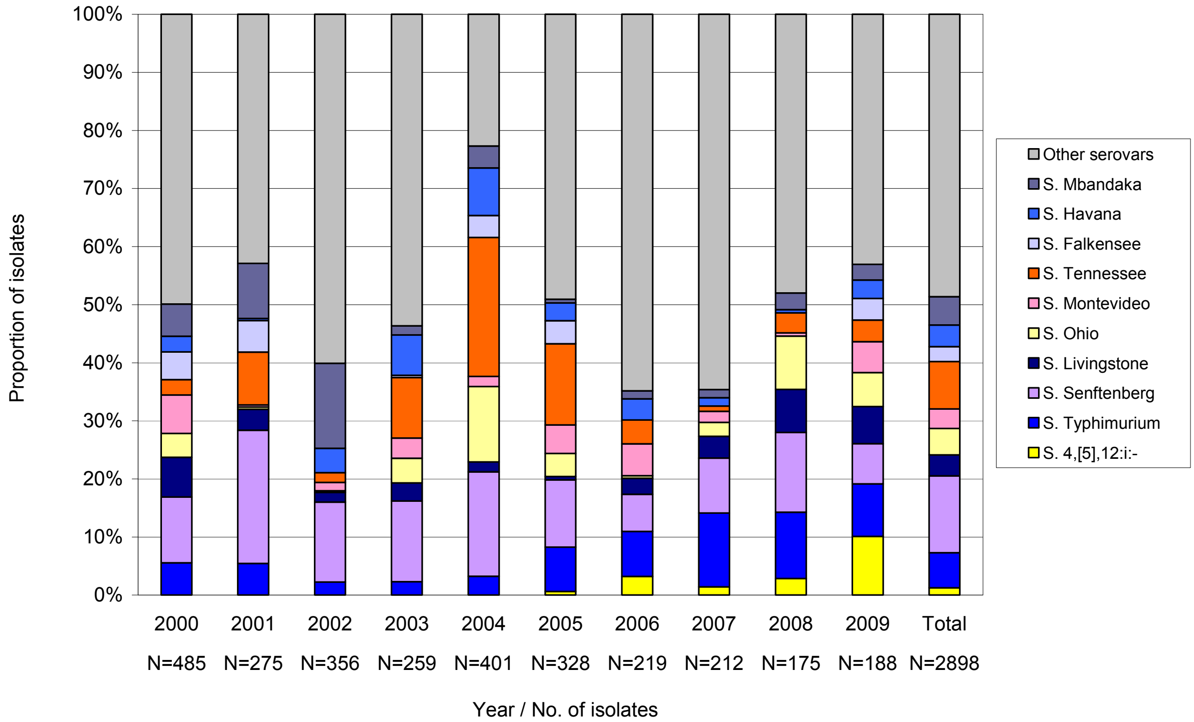
A total of 188 isolates from feeding stuffs were typed. The most common serovars were the monophasic variant of *S.* Typhimurium (*S.* 4,[5],12:i:-) (10.1 %), *S.* Typhimurium (9.0 %), *S.* Senftenberg (6.9 %), *S.* Livingstone (6.4 %), *S.* Ohio (5.9 %) and *S.* Montevideo (5.3 %). *S.* Enteritidis was only represented with one isolate. Almost 23 % of all isolates from feeding stuffs did not belong to any of the 20 most common serovars from feeding stuffs.

In addition to the 20 most common serovars in the total collective, the 20 most common serovars from feeding stuff samples are listed in Table 4.1. On top of the most common serovars from the total collective, *S.* Brandenburg, *S.* Havana, *S.* Agona, *S.* Cerro, *S.* Schwarzengrund, *S.* Falkensee, *S.* Orion, and *S.* Idikan were among the 20 most common isolates achieving a percentage between 1.6 and 3.7 % with feeding stuffs.

The distribution of the serovars varied considerably in isolates from feeding stuffs between the years (Fig. 4.4). The increase of the monophasic variant of *S.* Typhimurium (*S.* 4,[5],12:i:-) and decrease of *S.* Senftenberg are conspicuous in 2009.

Detailed data on this are listed in Table 20.4 in the appendix.

Fig. 4.4: Proportions of the ten most frequent serovars among isolates from feeding stuffs (2000–2009)



4.1.4 Serovars from animals

A total of 1,901 isolates from animals were tested for their resistance characteristics. These consisted of isolates from livestock and household pets, as well as animals kept in sanctuaries and zoos. A detailed observation of the serovars among the individual livestock species is contained in Chapter 5.

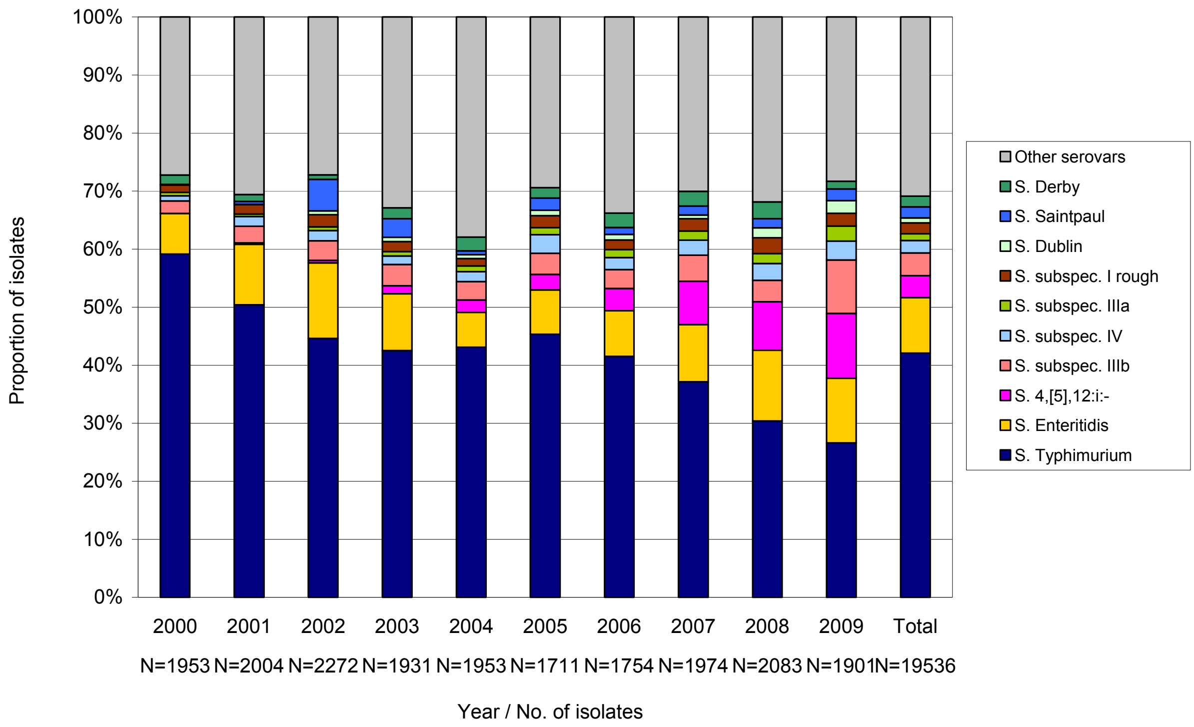
In 2009 once again, the by far most dominant serovar from animals remained *S.* Typhimurium (26.6 %), followed by its monophasic variant and *S.* Enteritidis, each with 11.2 % of the isolates (Tab. 4.1). *Salmonella* of the subspecies IIIb was represented for the first time with a share of over 5 % in the collective. The share was below 5 % for all of the other serovars individually. A total of twelve of the 20 most common serovars in the total collective had a proportion of at least 1 % of all isolates with isolates of animals while 18.0 % of the isolates of animals did not belong to any of the 20 most common serovars in the total collective.

In addition to the 20 most common serovars in the total collection, the 20 most common serovars from animal samples are listed in Table 4.1. On top of the most common serovars from the total collection, *Salmonella* of the subspecies II, *S.* Virchow and *S.* Kisarawe was among the most common serovars from animals and is represented in this collection with a share of at least 0.8 %.

The proportions of the most common serovars in animals in the period 2000–2009 are shown in Figure 4.5. Compared with over 50 % in the years 2000 and 2001, the proportion of *S.* Typhimurium dropped continuously and reached its lowest value of 26.6 % in 2009. In contrast, the proportion of its monophasic variant increased once again in 2009. In 2008, this serovar accounted for 8.4 % of all isolates from animals and 11.2 % in 2009. With 11.2 % in 2009, the proportion of *S.* Enteritidis was in the range of the values of previous years; it varied between 6 % and 13 % in the years 2000–2008.

Detailed data on this are listed in Table 20.5 in the appendix.

Fig. 4.5: Proportions of the ten most frequent serovars among isolates from animals (2000–2009)



4.1.5 Serovars from food

A total of 883 isolates from food were tested for their resistance characteristics. These isolates originated mainly from food of animal origin. A detailed review of the serovars from selected food groups can be found in Chapter 6.

Similar to the situation with animals, the predominant serovar from food was *S*. Typhimurium (21.0 %), followed by its monophasic variant (17.9 %) and *S*. Enteritidis (11.9 %) (Tab. 4.1). *S.* Derby was also present with a proportion of 5.9 %. All other serovars accounted for a proportion of less than 5 % each.

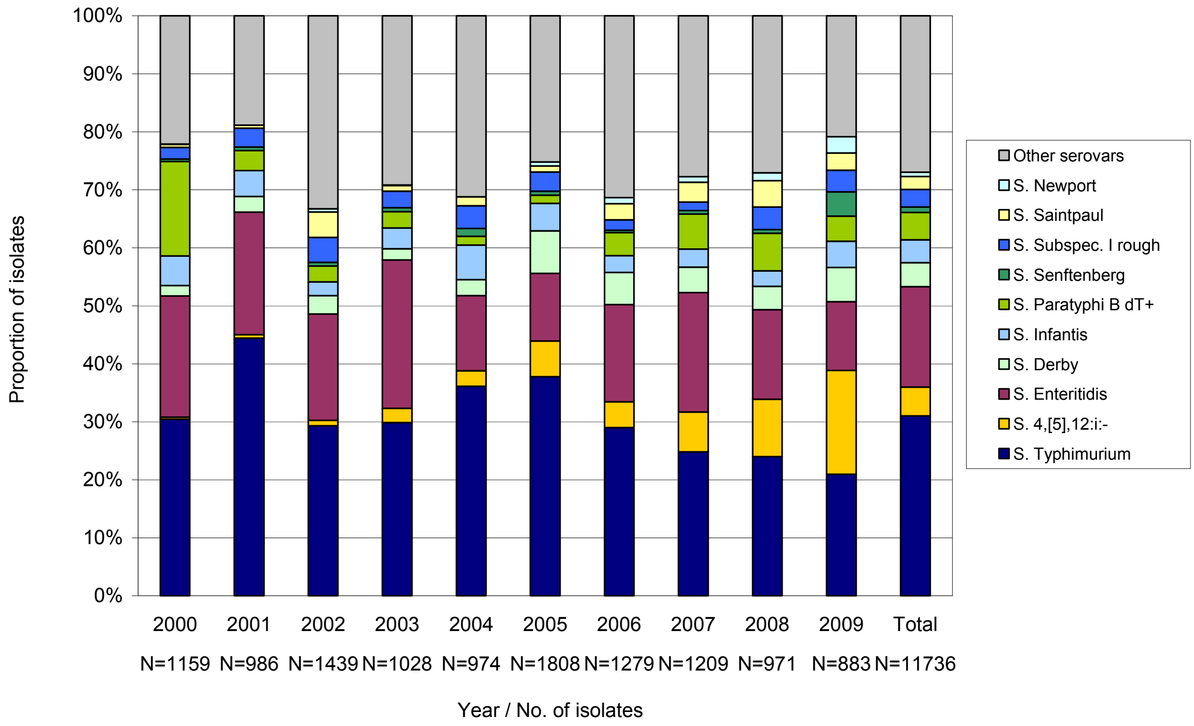
15 of the 20 most common serovars in the total collective each accounted for at least 1 % of all isolates from food; 13.6 % of all isolates from food did not belong to any of these 20 serovars.

In addition to the 20 most common serovars in the total collective, the 20 most common serovars from food samples are listed in Table 4.1. On top of the most common serovars from the total collection, *S.* Brandenburg, *S.* 4,12:d:-, *S.* Hadar and *S.* Bovismorbificans were among the 20 most common serovars from food and had a share of at least 0.8 % in this collective.

The distribution of the most common serovars in the period 2000–2009 is shown in Figure 4.6. The trend of *S.* Typhimurium, which has been on the decline since 2006, continued in 2009, whereas the monophasic variant increased significantly over the value of the previous year (9.9 %) with a proportion of 17.9 % in 2009. The proportion of *S.* Enteritidis decreased further in 2009 compared to the previous year and with 11.9 %, almost reached the value achieved in 2005, the year with the lowest proportion of *S.* Enteritidis to date. *S.* Paratyphi B dT+, which increased to over 6 % in 2007 and 2008, showed a slight downward trend in 2009 with 4.3 %.

Detailed data on this are listed in Table 20.6 in the appendix.

Fig. 4.6: Proportions of the ten most frequent serovars among isolates from food (2000–2009)

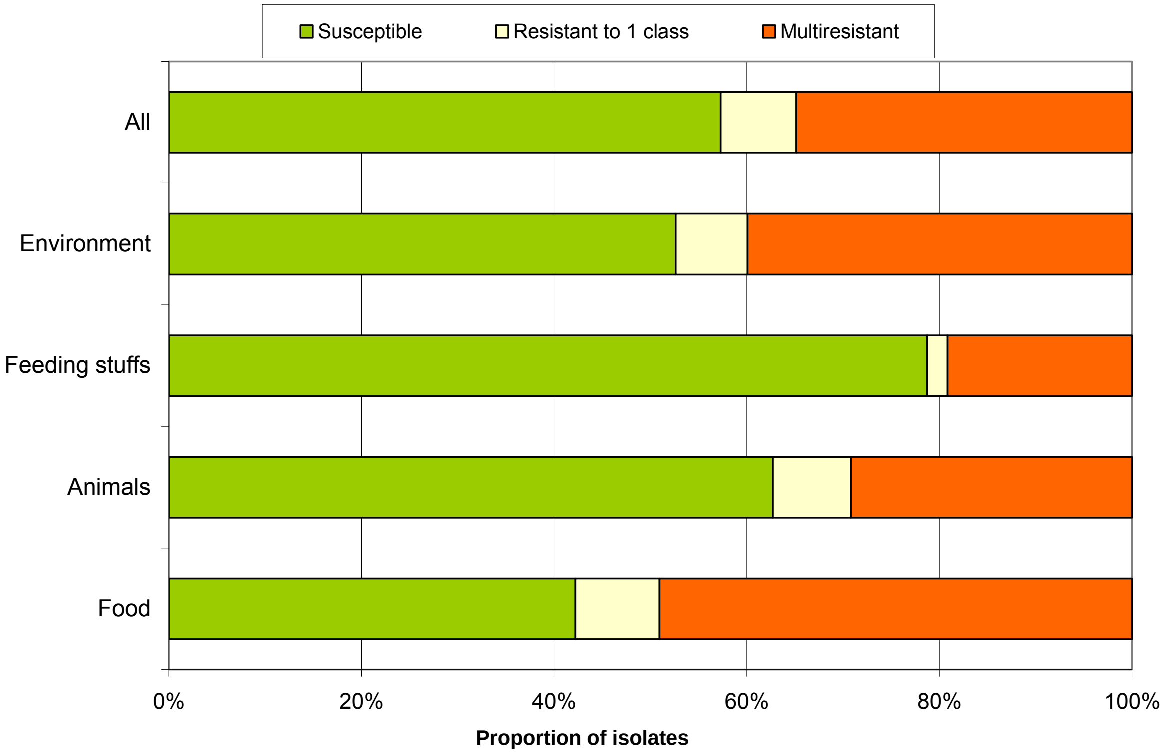


4.2 Resistance situation in *Salmonella* spp.

4.2.1 Overall resistance situation

Figure 4.7 gives an overview of resistance in *Salmonella* spp. in the total collective of the isolates. On average, 57.3 % of the isolates were susceptible to all of the tested antimicrobial substances, 42.7 % showed resistance to at least one active substance class and 34.8 % were resistant to several active substance classes. Differences become apparent when the origin of the isolates is taken into account. Whereas almost 80 % of the *Salmonella* isolates from feeding stuffs were susceptible to all of the tested active substance classes, this proportion in the isolates from animals, environmental samples and food was 62.7 %, 52.6 % and 42.2 % respectively. Accordingly, with a proportion of almost 50 %, multiresistant isolates were most common in isolates from food.

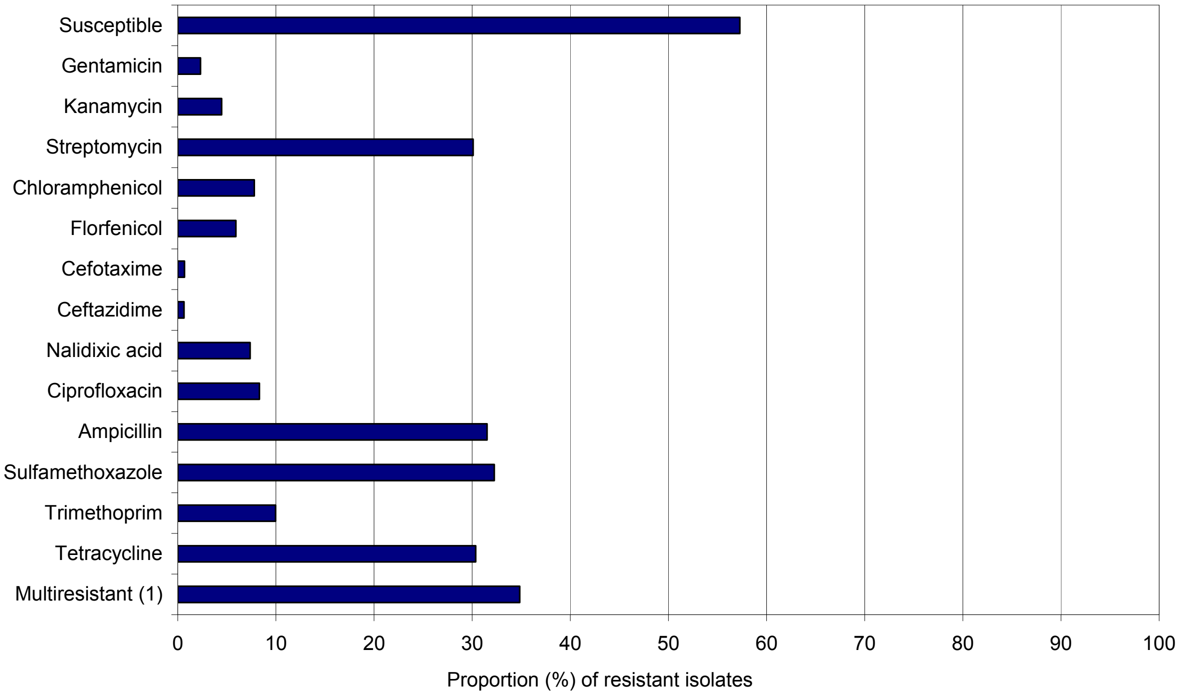
Fig. 4.7: Resistance of *Salmonella* spp. by origin (2009). Proportion of susceptible, resistant and multiresistant isolates (N=3.200)



If the resistance situation for the individual active substances is viewed as a whole for *Salmonella* spp. without considering the serovar and origin of the isolates, the highest resistance rate of 32.3 % was observed once again to sulfonamides in 2009 (Fig. 4.8). Resistance to ampicillin (31.5 %), tetracycline (30.4 %) and streptomycin (30.1 %) was also detectable in over 30 % of the isolates. Resistance to the other tested aminoglycosides, gentamicin und kanamycin, continued to be below 5 %. With 7.4 % and 8.3 % respectively, the resistance rates to the (fluoro)quinolones nalidixic acid and ciprofloxacin were in a similar range as in the average for the years 2000–2008. Several isolates with cephalosporin resistance were observed once again. 22 isolates (0.7 %) showed a resistance to cefotaxime and 20 (0.6 %) to ceftazidime.

Detailed data on this are listed in Table 20.7 in the appendix. The distribution of the MIC values with all Salmonella isolates is shown in Table 20.13 in the appendix.

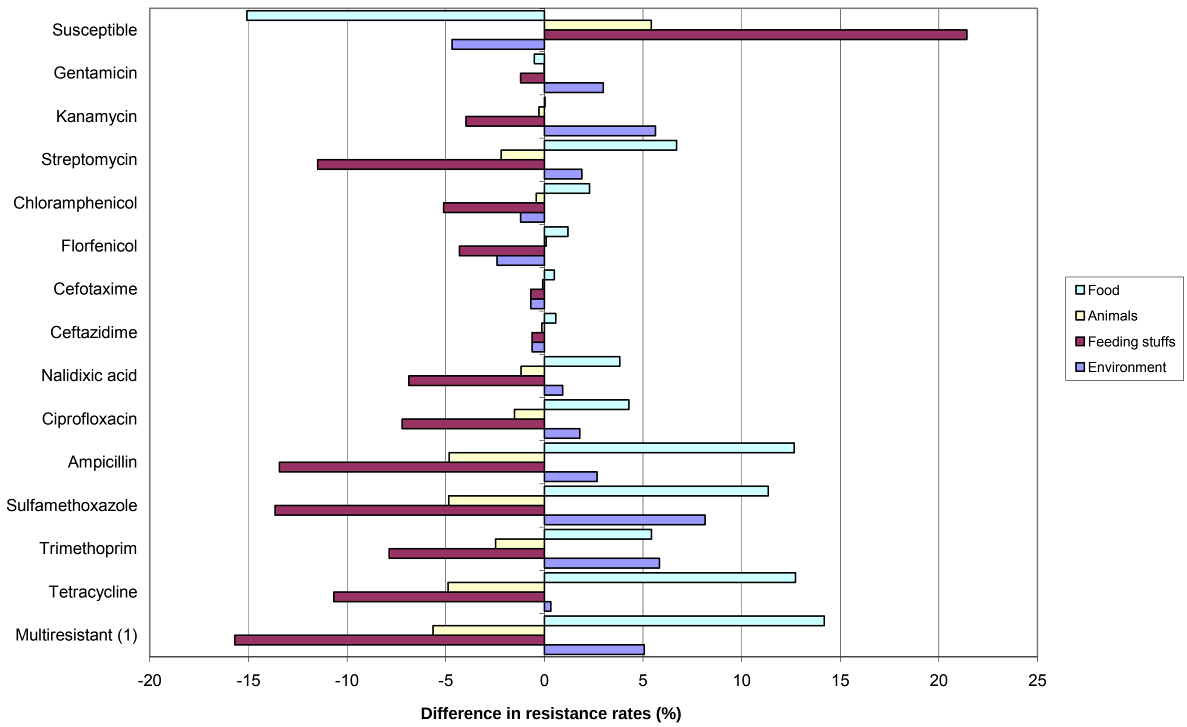
Fig. 4.8: Resistance of *Salmonella* spp. (all sources and origins) to antimicrobial substances (N=3.200) (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

There were marked differences between different origins and serovars. Figure 4.9 compares the difference in the resistance rates of the individual origins with the resistance rate of all isolates. For the vast majority of the substance classes, the isolates from feeding stuffs and to an extent those from animals showed lower resistance rates compared with the average value for all origins. The above-average proportion of resistant isolates from food is particularly conspicuous.

Fig. 4.9: Difference in the rates of *Salmonella* spp. from different origins to the resistance rates of *Salmonella* spp. from all origins (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

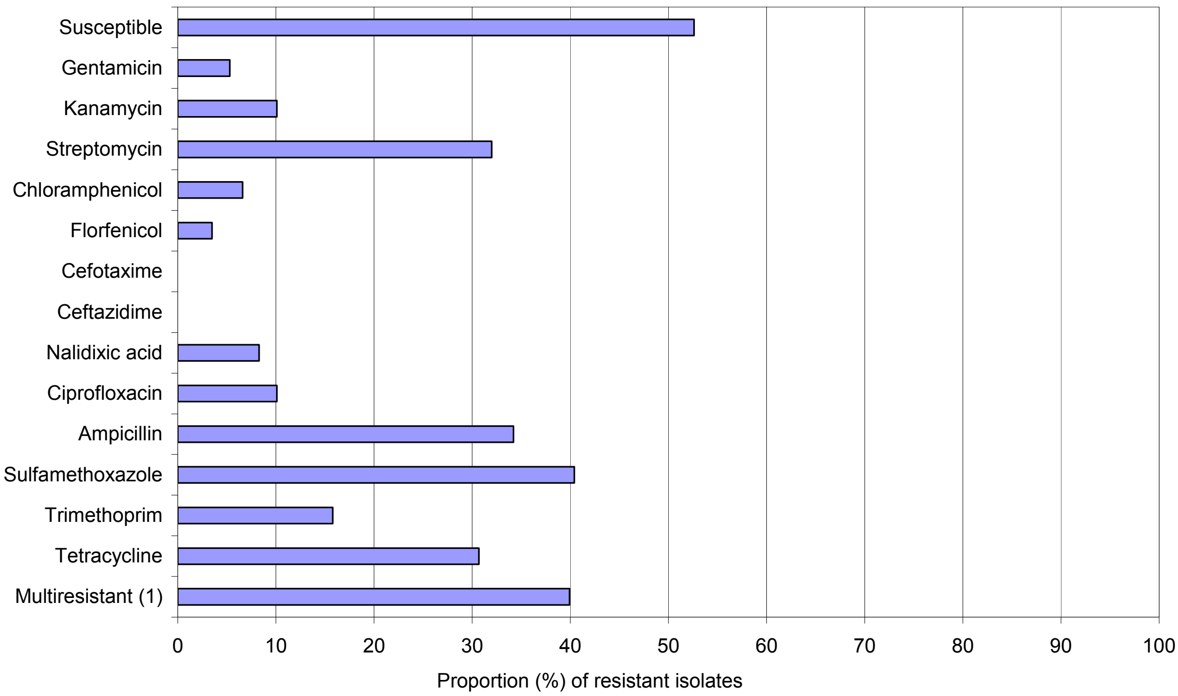
4.2.2 Resistance situation in isolates from the environment

In comparison with the situation with *Salmonella* spp. in the total collective, the resistance pattern of isolates from the environment was similar, although some of the resistance rates were higher when compared with the results of previous years (2000–2008) (Fig. 4.10). This was particularly apparent for those active substances with high resistance rates, i.e. sulfamethoxazole, tetracycline, ampicillin and streptomycin. The resistance rates in 2009 were up to 8 % higher than the overall average.

With 8.3 % (nalidixic acid) and 10.1 % (ciprofloxacin), resistance to quinolones were also observed slightly more frequently in isolates from the environment. As in previous years, no resistance to cefotaxime and ceftazidime was observed in 2009.

Detailed data on this are listed in Table 20.7 in the appendix. The distribution of the MIC values with all *Salmonella* isolates, as well as the most common serovars from environmental samples, is shown in Tables 20.14–20.25 in the appendix.

Fig. 4.10: Resistance rates in *Salmonella* spp. from the environment (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

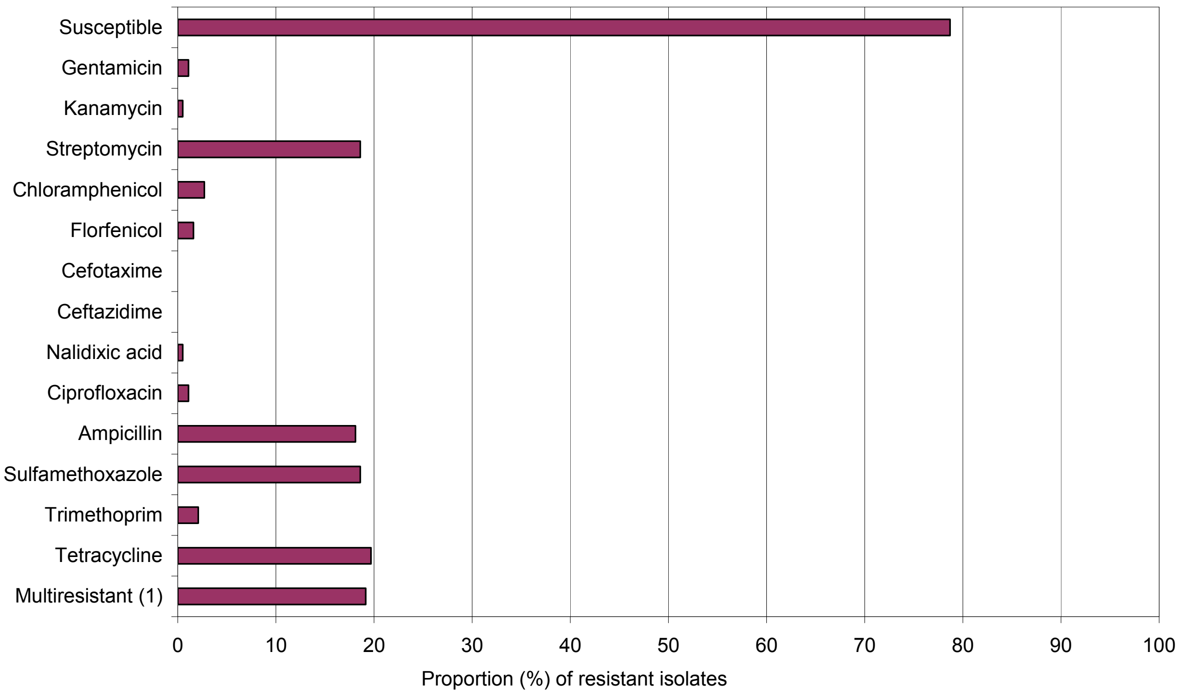
4.2.3 Resistance situation in isolates from feeding stuffs

As in previous years, the resistance rates in *Salmonella* spp. from feeding stuffs was considerably lower compared to the total collective of *Salmonella* isolates. Significantly lower resistance rates were observed above all for sulfamethoxazole and ampicillin, as well as streptomycin and tetracycline. The resistance rates for these active substances ranged between 18 and 20 %. The resistance rates for all other active substances were below 5 % as in previous years (Fig. 4.11).

As with the environmental and feeding stuff isolates in the previous years, no resistances to cefotaxime and ceftazidime were observed in 2009. Resistances to (fluoro)quinolones continued to be very rare (0.5 % to nalidixic acid and 1.1 % to ciprofloxacin) in this collective.

Detailed data on this are listed in Table 20.7 in the appendix. The distribution of the MIC values with all *Salmonella* isolates, as well as the most common serovars from feeding stuff samples, is shown in Tables 20.26–20.38 in the appendix.

Fig. 4.11: Resistance rates in *Salmonella* spp. from feeding stuffs (2009)



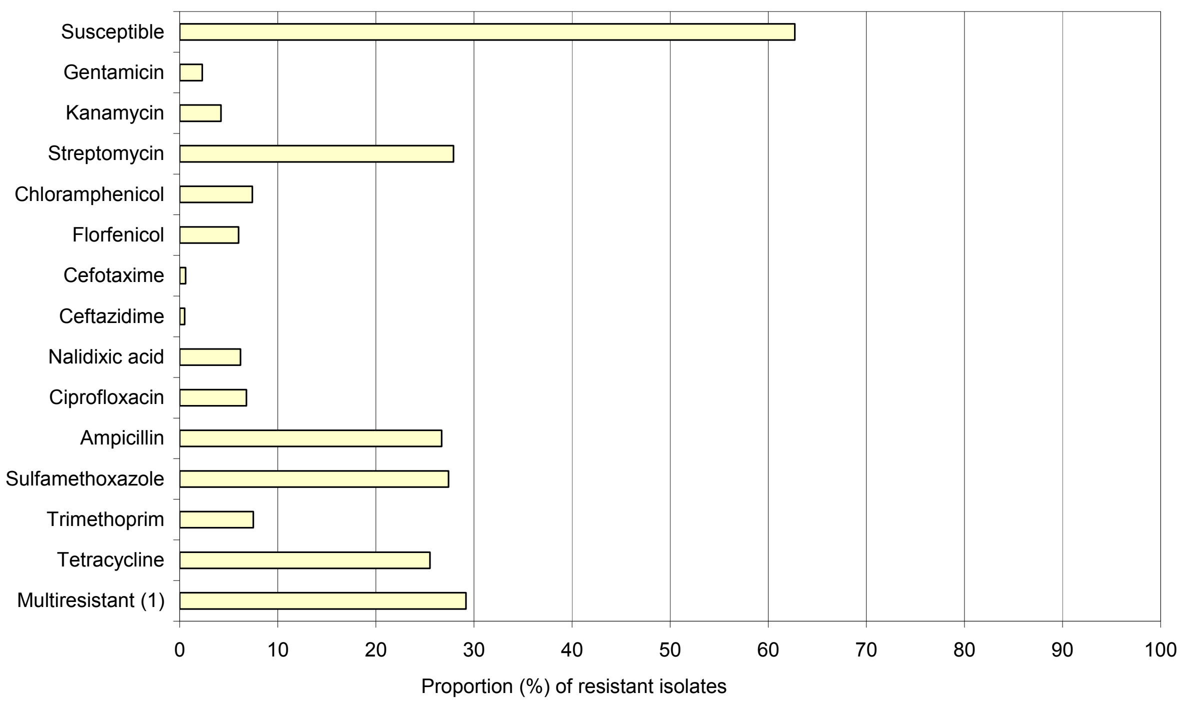
(1) Multiresistant = resistant to more than one class of antimicrobials

4.2.4 Resistance situation in isolates from animals

The resistance pattern of *Salmonella* isolates from animals resembled that of the total spectrum. A slightly lower rate was observed for almost all active substances compared to the total collective. As in the previous years, Salmonella isolates from animals showed the highest resistances to streptomycin, sulfamethoxazole, ampicillin and tetracycline. In comparison with the isolates from the period 2000–2008, however, the rate of resistance to chloramphenicol and florfenicol was significantly lower. Resistance to nalidixic acid and ciprofloxacin was determined in 6.2 % and 6.8 % of the isolates respectively. Nine (0.5 %) and 11 (0.6 %) respectively of the isolates were resistant to ceftazidime and cefotaxime, which have been tested since 2008 (Fig. 4.12).

Detailed data on this are listed in Table 20.7 in the appendix. The distribution of the MIC values with all *Salmonella* isolates, as well as the most common serovars from animal samples, is shown in Tables 20.39–20.49 in the appendix.

Fig. 4.12: Resistance rates in *Salmonella* spp. from animals (2009)



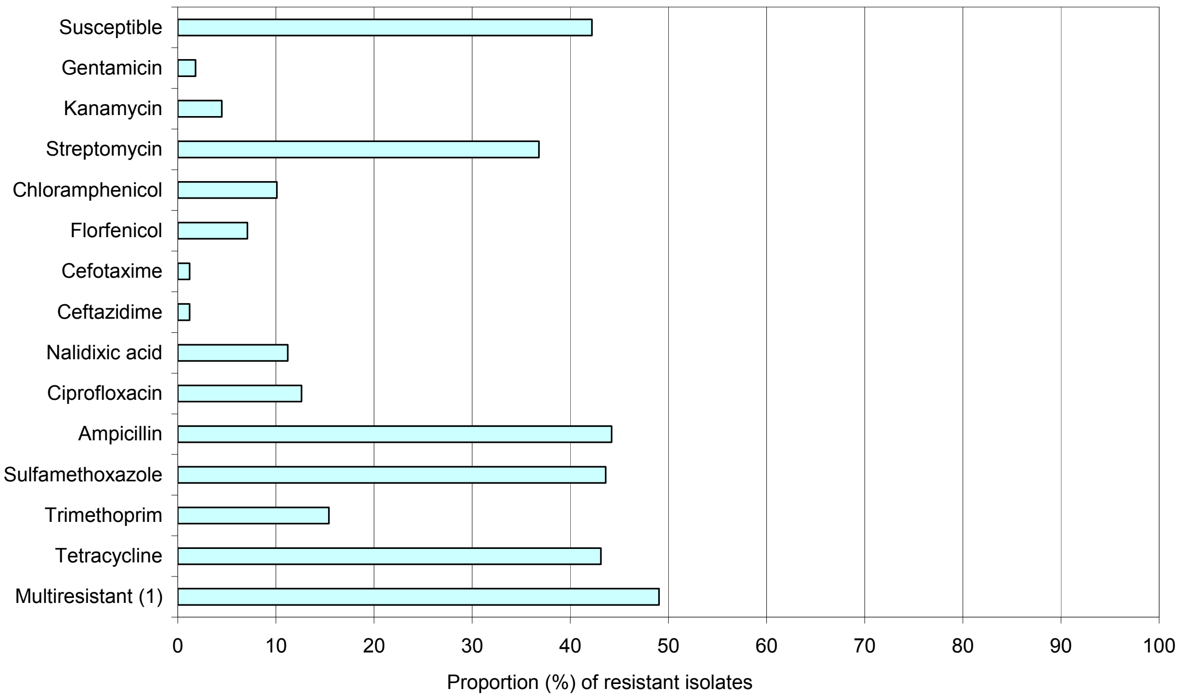
(1) Multiresistant = resistant to more than one class of antimicrobials

4.2.5 Resistance situation in isolates from food

The resistance pattern of *Salmonella* isolates from food was similar to that of isolates from animals, but the resistance rates were well above the average for the total collective. Resistance to ampicillin, sulfamethoxazole, tetracycline and streptomycin was recorded most frequently with rates between 36.8 % and 44.2 %. The highest rates of quinolone resistance were determined once again in isolates from food with 11.2 % towards nalidixic acid and 12.6 % towards ciprofloxacin. Higher rates compared to isolates from animals were also observed with the third generation cephalosporins. Eleven (1.2 %) of the isolates were resistant to cefotaxime and ceftazidime (Fig. 4.13).

Detailed data on this are listed in Table 20.7 in the appendix. The distribution of the MIC values with all *Salmonella* isolates, as well as the most common serovars from food samples, is shown in Tables 20.50–20.60 in the appendix.

Fig. 4.13: Resistance rates in *Salmonella* spp. from food (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

4.3 Resistance situation in the most common serovars of *Salmonella* spp.

Figure 4.14 gives an overview of the resistance rates with the two serovars most common in humans, *S.* Enteritidis and *S.* Typhimurium. Big differences were apparent here. Whereas for *S.* Enteritidis more than 90 % of the isolates were completely susceptible to all tested antimicrobial substance classes, this was only the case with 40 % of the *S.* Typhimurium isolates.

Multiple resistance is frequent with *S.* Typhimurium. Depending on the origin, between 22.2 % and 48.0 % of the *S.* Typhimurium isolates were susceptible to all of the tested antimicrobial substances. The proportion of multiple resistant isolates was between 42.7 % and 73.5 %, depending on the origin.

On average, more than 90 % of the *S.* Enteritidis isolates were susceptible to all of the tested antimicrobial substances. Several isolates (approx. 0.6 %) showed resistances to more than one antimicrobial substance class. All of these isolates were from animals.

Fig. 4.14: Resistance in *S.* Enteritidis and *S.* Typhimurium by origin (2009). Proportion of susceptible, resistant and multiresistant isolates

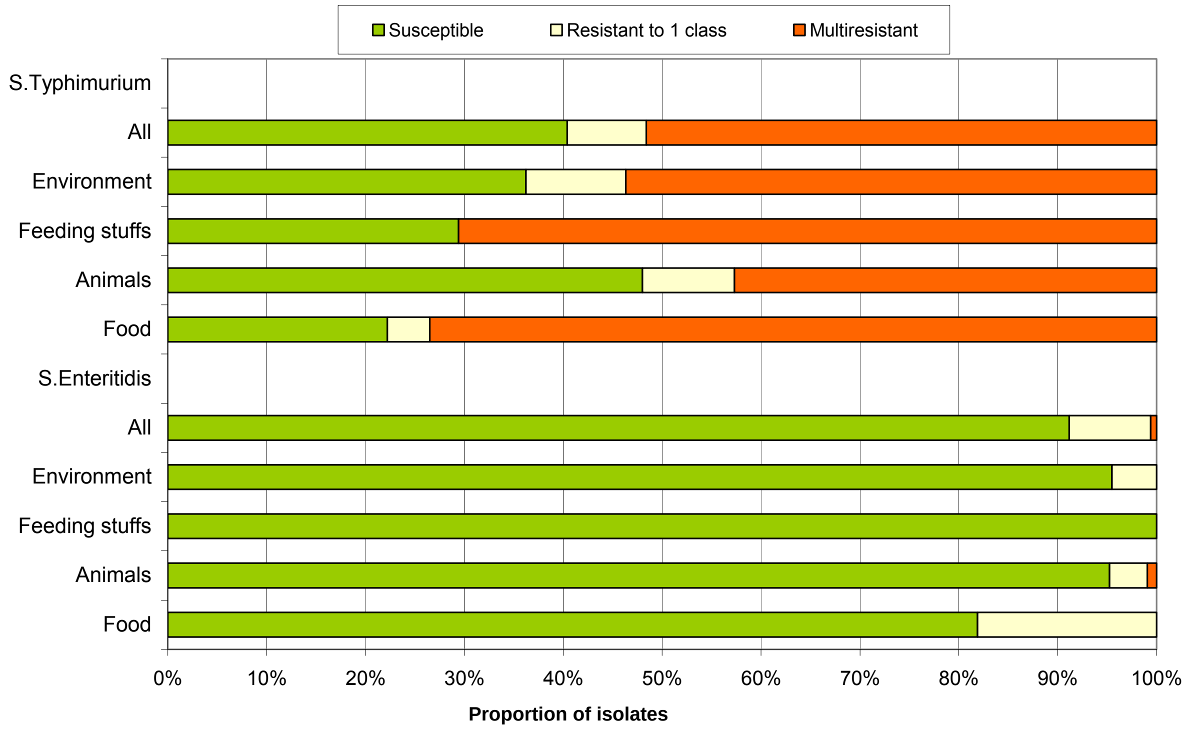


Figure 4.15 shows the resistance rates with the 22 most common serovars in the total collective of isolates. Big differences become apparent here. Whereas in 12 of the 22 serovars (*S.* Dublin, *S.* Enteritidis, *S.* Livingstone, *S.* London, *S.* Mbandaka, *S.* Montevideo, *S.* Ohio, *S.* Senftenberg, *S.* Tennessee and isolates of the subspecies IIIa, IIIb and IV) the vast majority (≥ 70 %) of the isolates was susceptible to all of the tested antimicrobial substance classes, resistance was determined very frequently (> 50 %) in *S.* Paratyphi B dT+, *S.* Saintpaul, *S.* Subspecies I rough, *S.* Typhimurium and the monophasic type *S.* 4,[5],12:i:- and usually to several substance classes.

In comparison with the resistance rate of all isolates of a serovar, Figure 4.15 also shows the differences in the resistance rates of the individual serovars depending on the origin of the isolates. There was a tendency that the lowest resistance rates were observed with isolates from feeding stuffs. For several serovars, however, only a limited number of isolates from feeding stuffs were available, if any. It is conspicuous that no isolates of *S.* Paratyphi B dT+ and *S.* Saintpaul from feeding stuffs were submitted. The four isolates from *S.* Subspec. I rough from feeding stuffs were fully susceptible, whereas this serovar from some other origins was highly resistant. It is also conspicuous that the proportion of susceptible feeding stuff isolates from *S.* Typhimurium and the monophasic Type *S.* 4,[5],12:i:- was well under the average of the isolates from all origins.

The resistance rates per antimicrobial substance are shown in Figure 4.16 for the 22 most common serovars in the total collective.

As in the previous years, resistance rates in the range of 50 % (48–51 %) were observed in *S.* Typhimurium for sulfamethoxazole, tetracycline, streptomycin and ampicillin. There were resistances of 20–50 % of the isolates for four other antimicrobial substances. Compared to *S.* Typhimurium, the monophasic variant *S.* 4,[5],12:i:- showed higher resistance rates to several active substances. The resistance profile differed fundamentally here from *S.* Typhimurium. Resistance to streptomycin, ampicillin and sulfamethoxazole was found in more than 90 % of the isolates of the monophasic variant *S.* 4,[5],12:i:- and resistance to tetracycline was often found in addition.

Resistance to (fluoro)quinolones and ampicillin was observed almost exclusively with the *S.* Enteritidis isolates.

55 % of *S.* Infantis isolates and all five of the isolates from feeding stuffs were susceptible to all antimicrobial substance classes. Resistances to several active substance classes were observed with 36 % of all *S*. Infantis isolates. This proportion was highest with isolates from food and animals. As in previous years, it was conspicuous with *S.* Infantis that resistance to quinolones was detected in 33 % of the 40 isolates from food but only in 8 % of the 24 isolates from animals.

More than 60 % of the *S.* Derby isolates were susceptible to all of the tested antimicrobial substances. The isolates from food, animals and the environment showed similar values here, whereas only one isolate from feeding stuffs was tested which was susceptible.

The resistance rates for the most common serovars, including consideration of their origin, are listed in Tables 20.8–20.12 in the appendix.

Fig. 4.15: Resistance in the 20 most frequent *Salmonella* serovars by origin (2009). Proportion of susceptible, resistant and multiresistant isolates – Part 1

Fig. 4.15: Resistance in the 20 most frequent *Salmonella* serovars by origin (2009). Proportion of susceptible, resistant and multiresistant isolates – Part 2

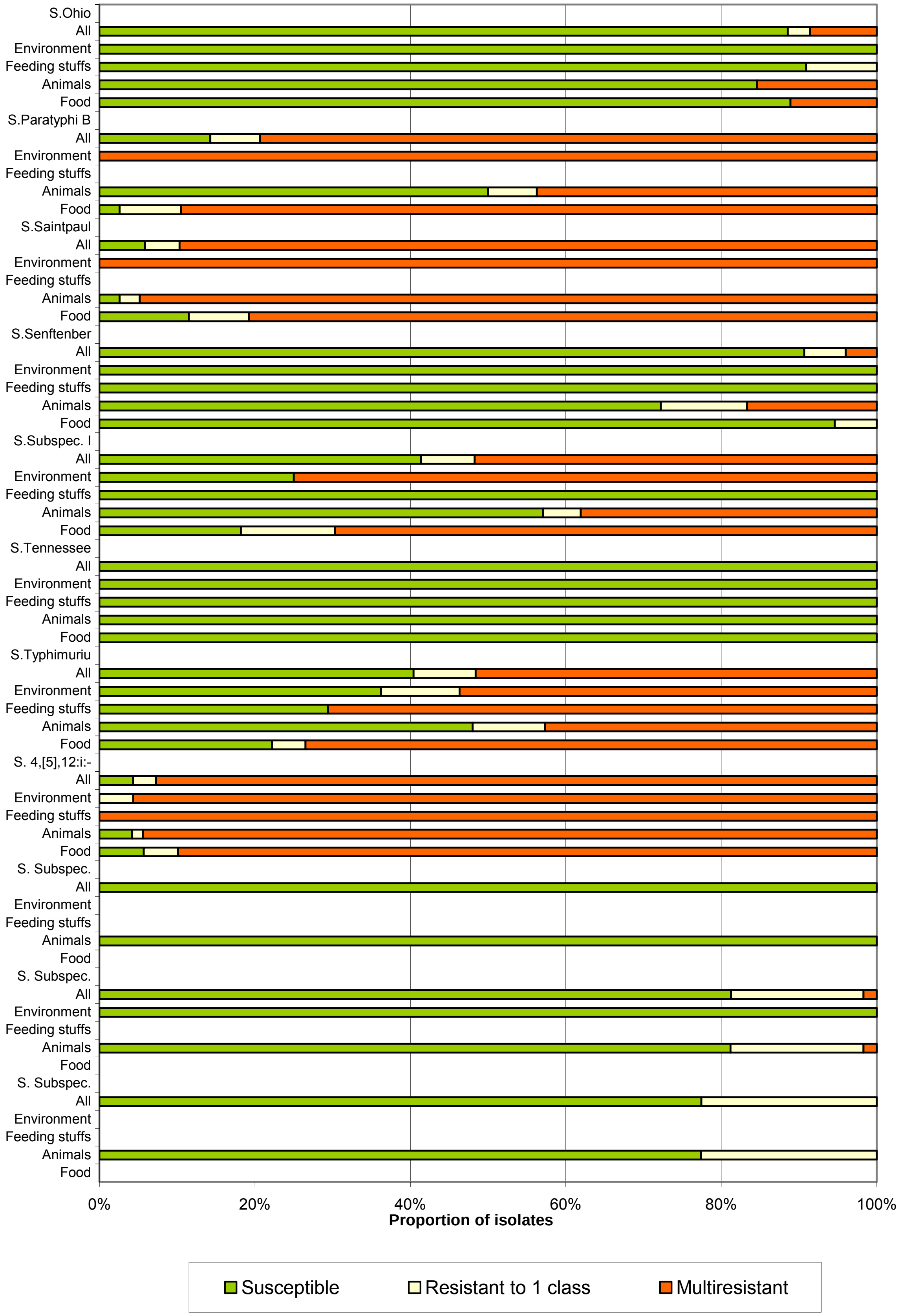
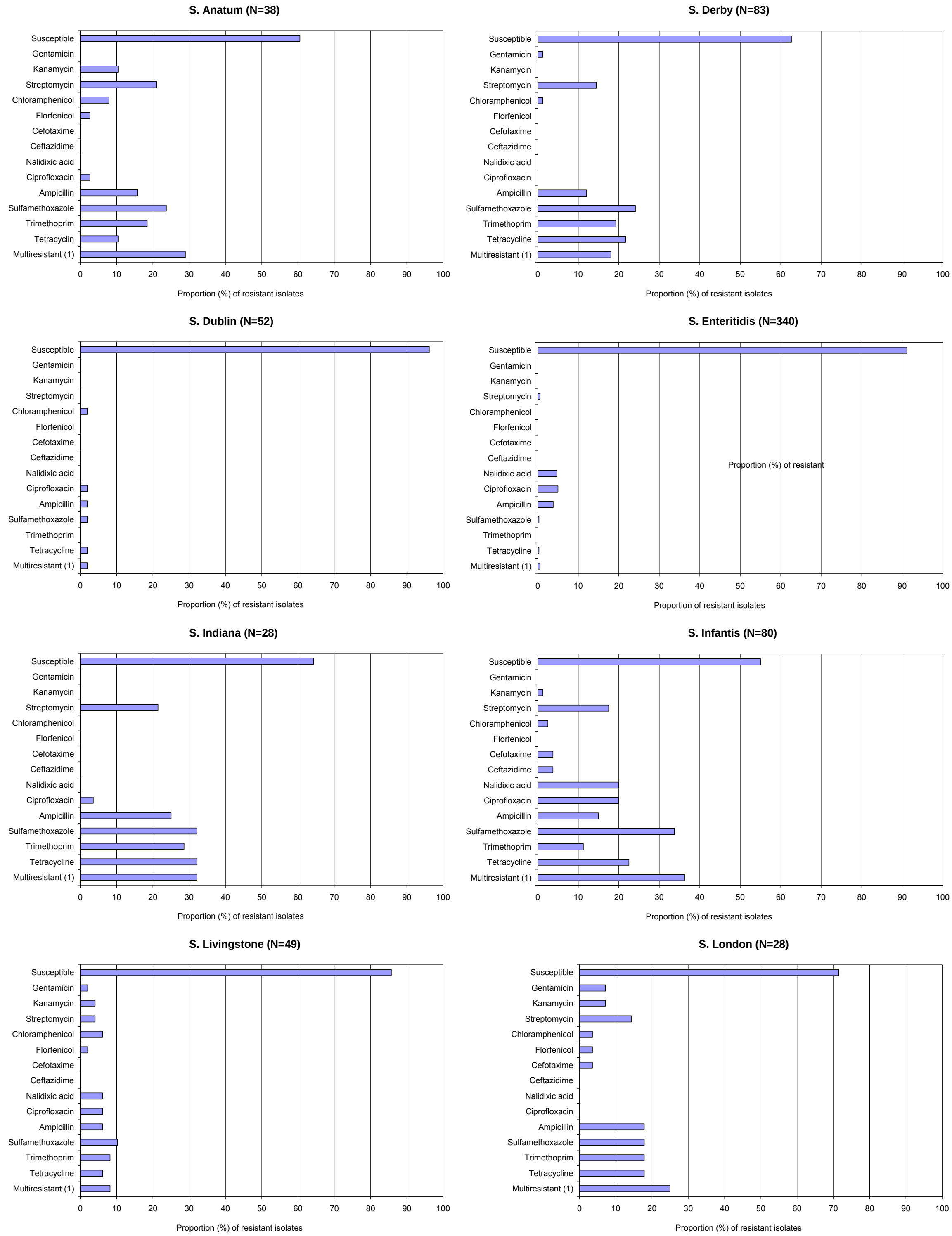
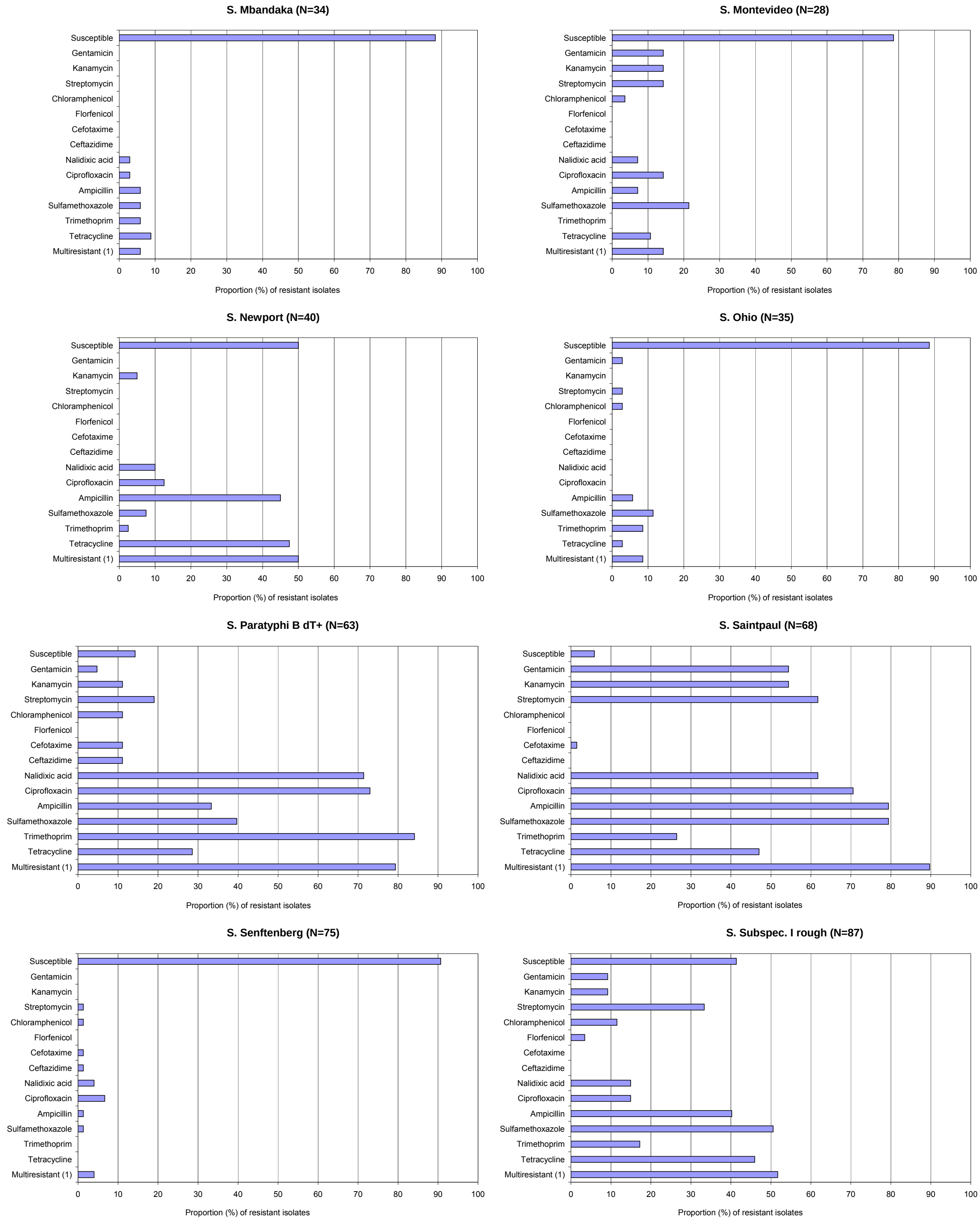


Fig. 4.16: Resistance rates in the 20 most frequent *Salmonella* serovars (2009) – Part 1



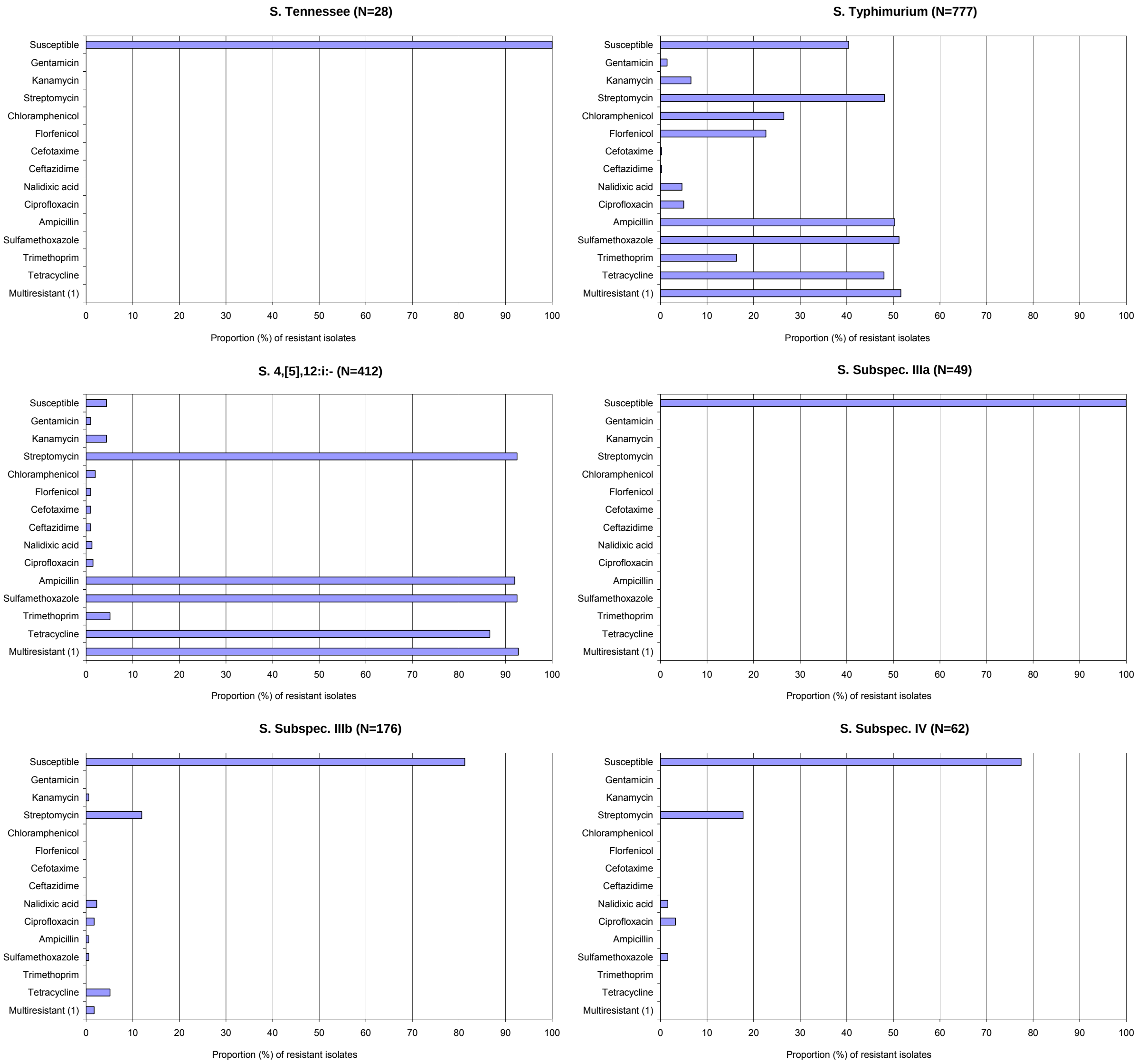
(1) Multiresistant = resistant to more than one class of antimicrobials

Fig. 4.16: Resistance rates in the 20 most frequent *Salmonella* serovars (2009) – Part 2



(1) Multiresistant = resistant to more than one class of antimicrobials

Fig. 4.16: Resistance rates in the 20 most frequent *Salmonella* serovars (2009) – Part 3



(1) Multiresistant = resistant to more than one class of antimicrobials

4.4 Resistance situation for individual active substances and active substance groups

4.4.1 Aminoglycosides

Figures 4.15 to 4.19 illustrate the differences regarding the resistance rates of the 22 most common serovars to the tested aminoglycosides. Higher rates of resistance to gentamicin and kanamycin were observed in isolates from the environment (above all *S.* Saintpaul, *S.* Montevideo and *S.* Subspec. I, rough) than in isolates from other origins. Only for *S.* Saintpaul high rates of resistance to gentamicin were also found in isolates from animals and food. Compared with the other aminoglycosides, very high resistance rates to streptomycin are evident with several serovars, in particular with *S.* Saintpaul, *S.* Typhimurium and the monophasic variant *S.* 4,[5],12:i:-.

Fig. 4.17: Resistance rates to gentamicin in the 20 most frequent *Salmonella* serovars (2009)

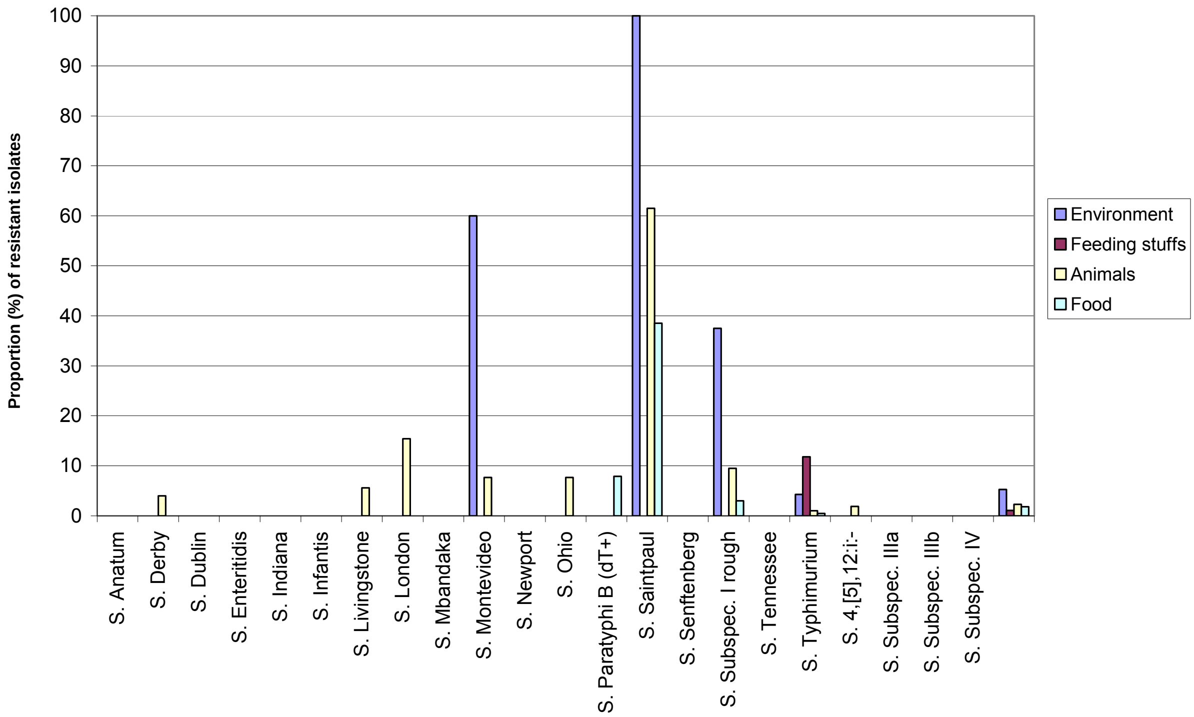


Fig. 4.18: Resistance rates to kanamycin in the 20 most frequent *Salmonella* serovars (2009)

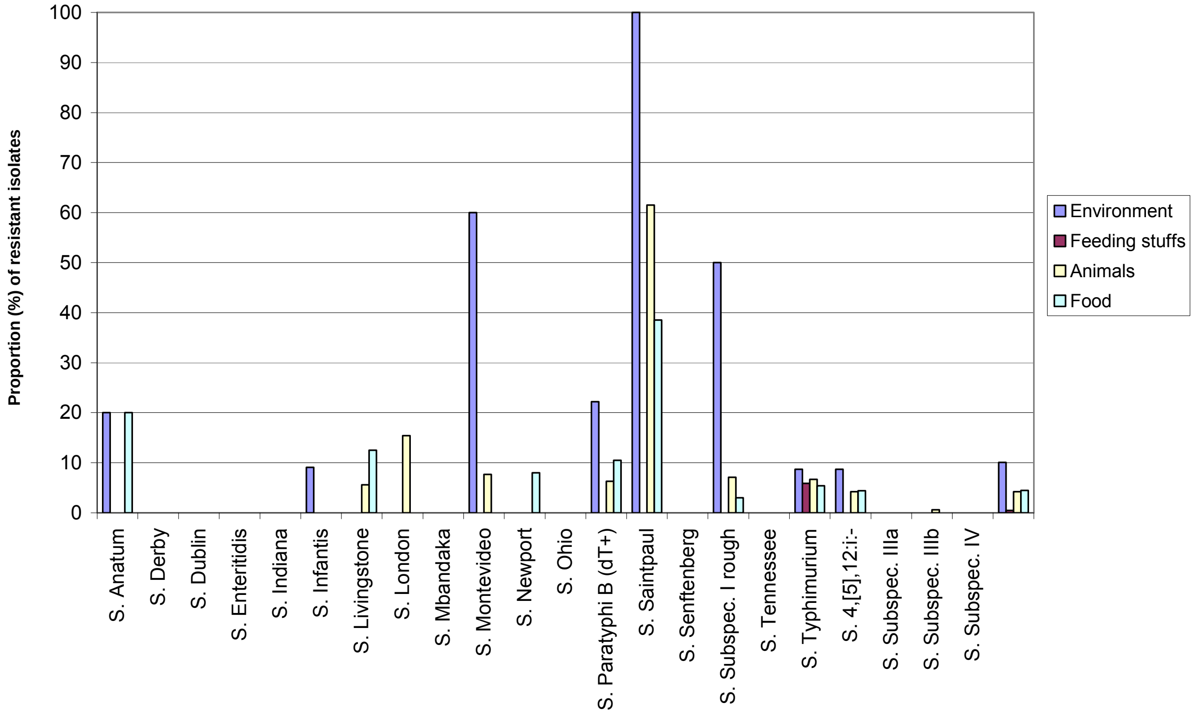
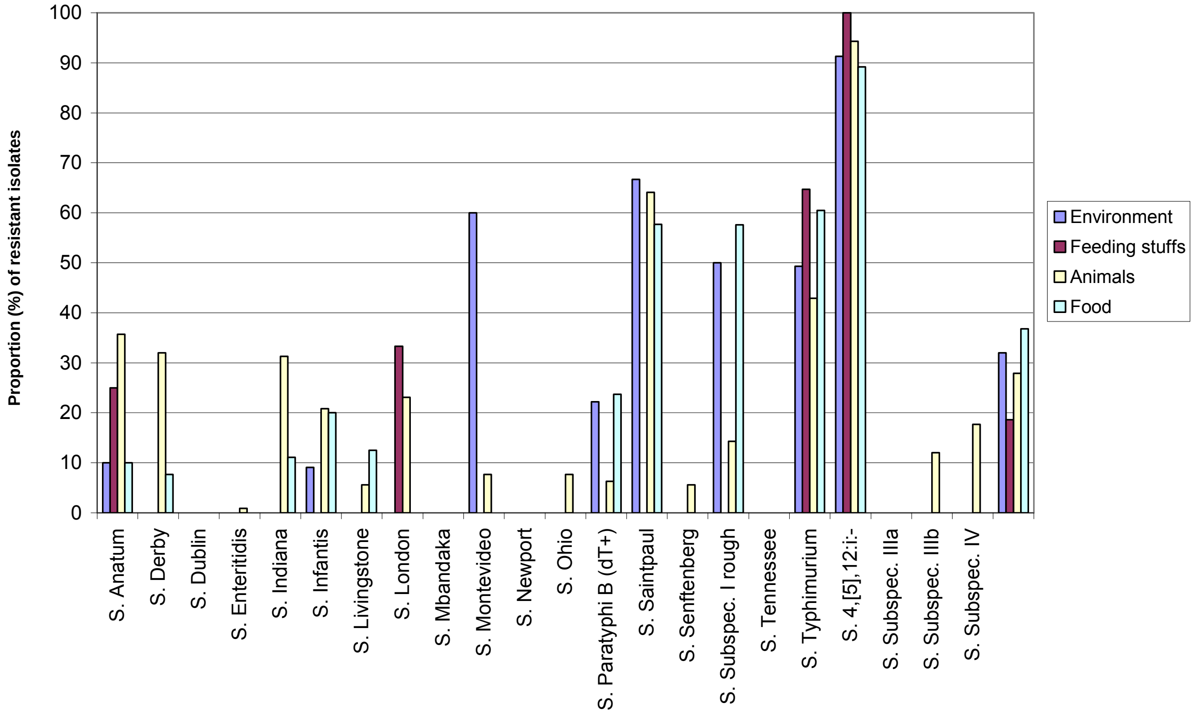


Fig. 4.19: Resistance rates to streptomycin in the 20 most frequent *Salmonella* serovars (2009)



4.4.2 Phenicols

Figures 4.20 and 4.21 illustrate the differences in the rates of resistance to chloramphenicol and florfenicol among the various serovars. Serovar-specific differences can be observed here too. As in previous years, more frequent resistance to chloramphenicol than to florfenicol was observed in several serovars. Resistance to both phenicols was detected most frequently with *S.* Typhimurium of different origins.

Fig. 4.20: Resistance rates to chloramphenicol in the 20 most frequent *Salmonella* serovars (2009)

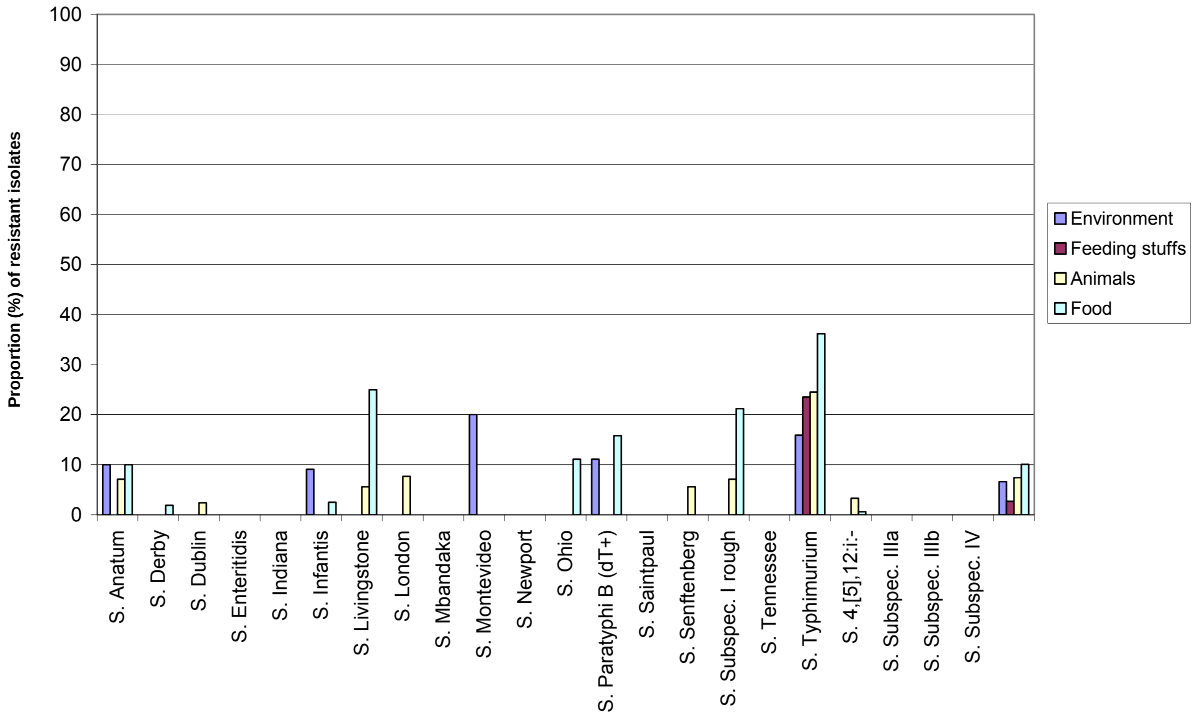
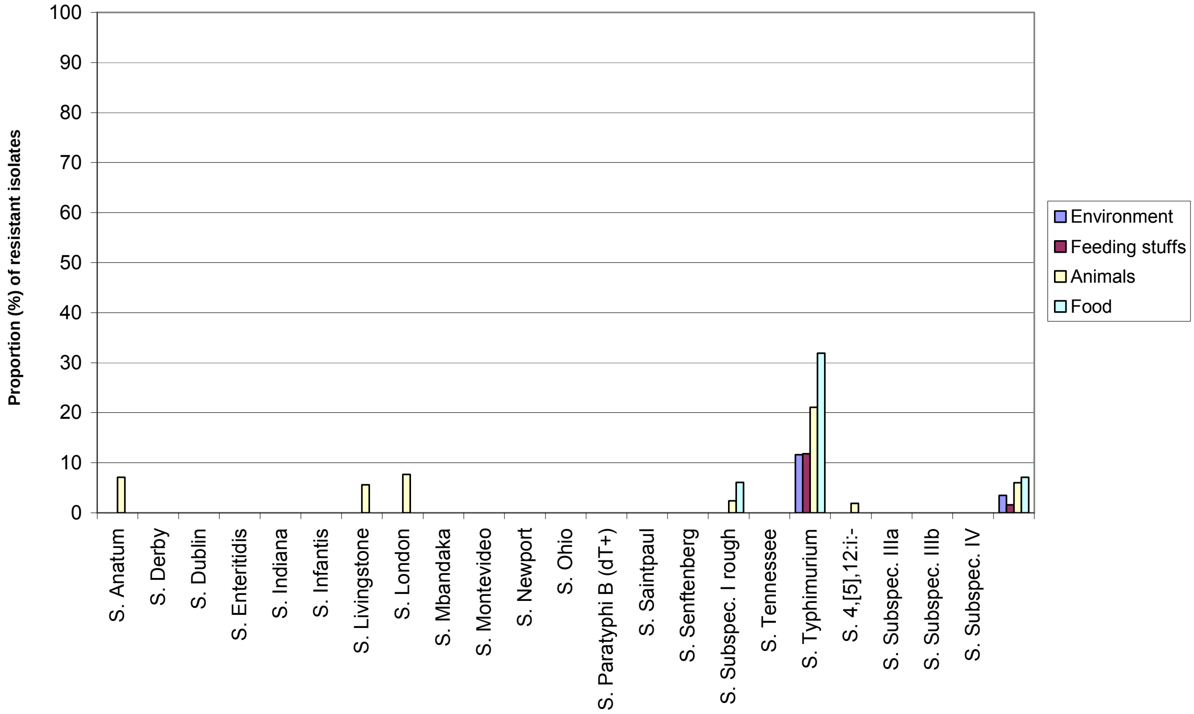


Fig. 4.21: Resistance rates to florfenicol in the 20 most frequent *Salmonella* serovars (2009)



4.4.3 Cephalosporins

Figures 4.22 and 4.23 show the resistance rates to the tested third generation cephalosporins among the various serovars. Resistances to cefotaxime and partly also to ceftazidime were observed in isolated instances with *S.* Infantis from animals and food, in *S.* London, *S.* Saintpaul, *S.* Senftenberg *S.* Typhimurium and the monophasic variant *S.* 4,[5],12:i:- from animals and particularly frequently in *S.* Paratyphi B dT+ from food (18.4 %; 38 isolates). Unlike previous years, no cephalosporin resistance was observed in the 16 *S.* Paratyphi B dT+-isolates from animals in 2009.

Fig. 4.22: Resistance rates to cefotaxime in the 20 most frequent *Salmonella* serovars (2009)

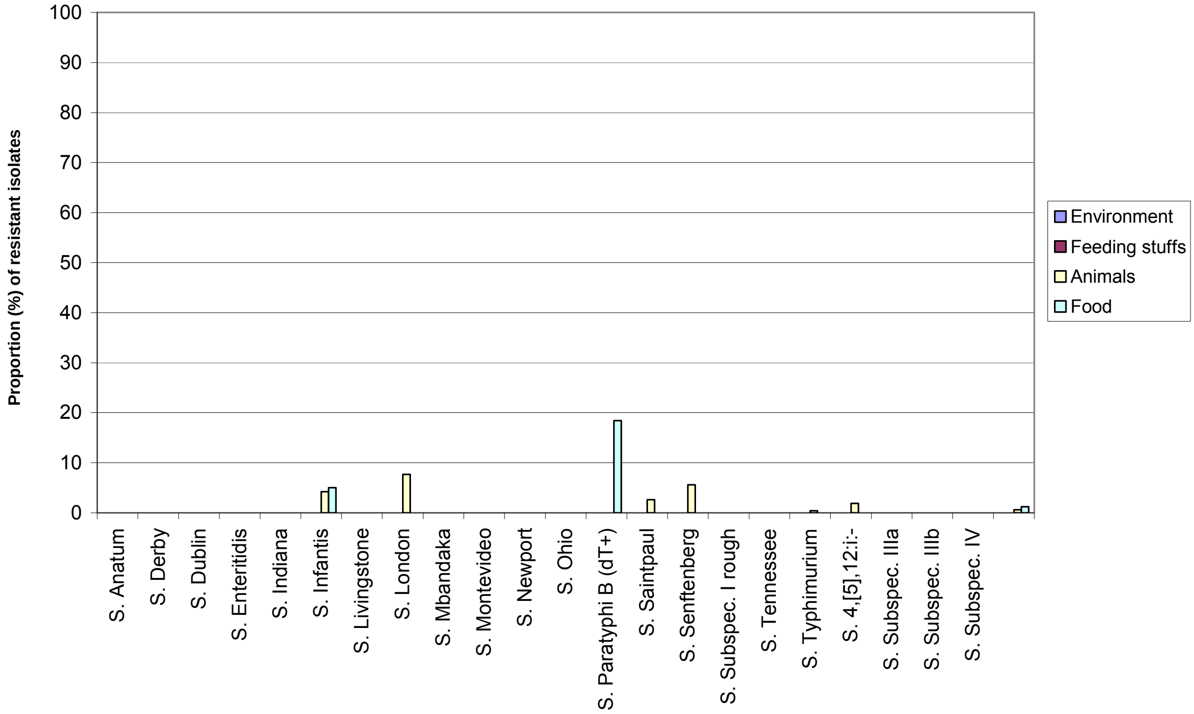
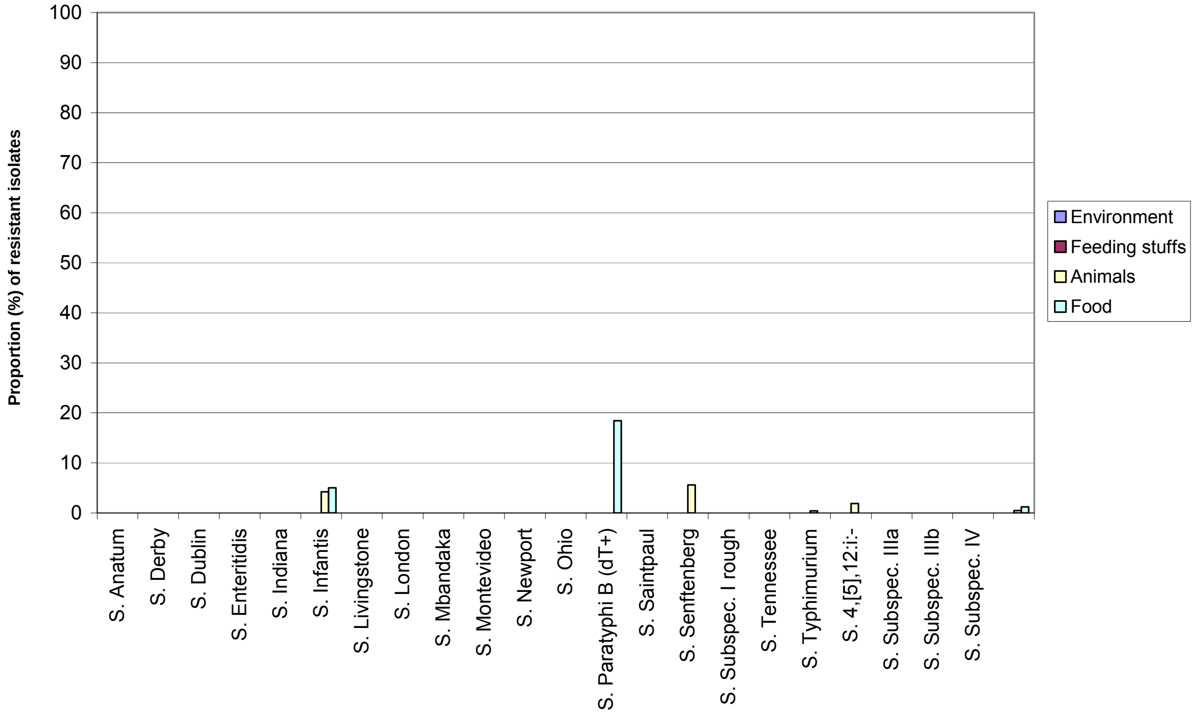


Fig. 4.23: Resistance rates to ceftazidime in the 20 most frequent *Salmonella* serovars (2009)



4.4.4 (Fluoro)quinolones

Figures 4.24 and 4.25 show the resistance rates among the various serovars to the two tested quinolones. As in previous years, very high resistance rates are conspicuous, especially with *S.* Paratyphi B dT+ and *S.* Saintpaul. On average, 73 % of the 63 isolates of *S.* Paratyphi B dT+ and 70.6 % of the 68 isolates of *S.* Saintpaul were resistant to ciprofloxacin. All nine isolates of *S.* Paratyphi B dT+ and all three isolates of *S.* Saintpaul from environmental samples were resistant to nalidixic acid and ciprofloxacin. Resistance rates of the isolates of *S.* Paratyphi B dT+ and *S.* Saintpaul from animals and food varied between 38 % and 82 %; no isolates from food were submitted in 2009.

Fig. 4.24: Resistance rates to nalidixic acid in the 20 most frequent *Salmonella* serovars (2009)

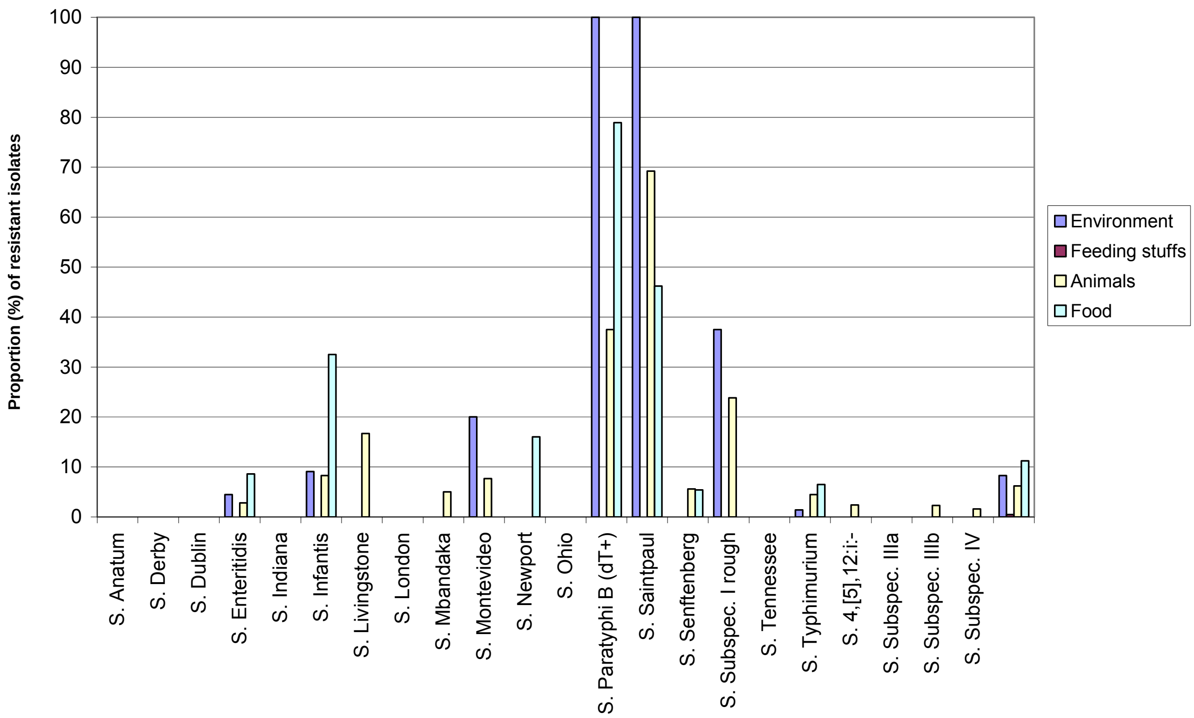
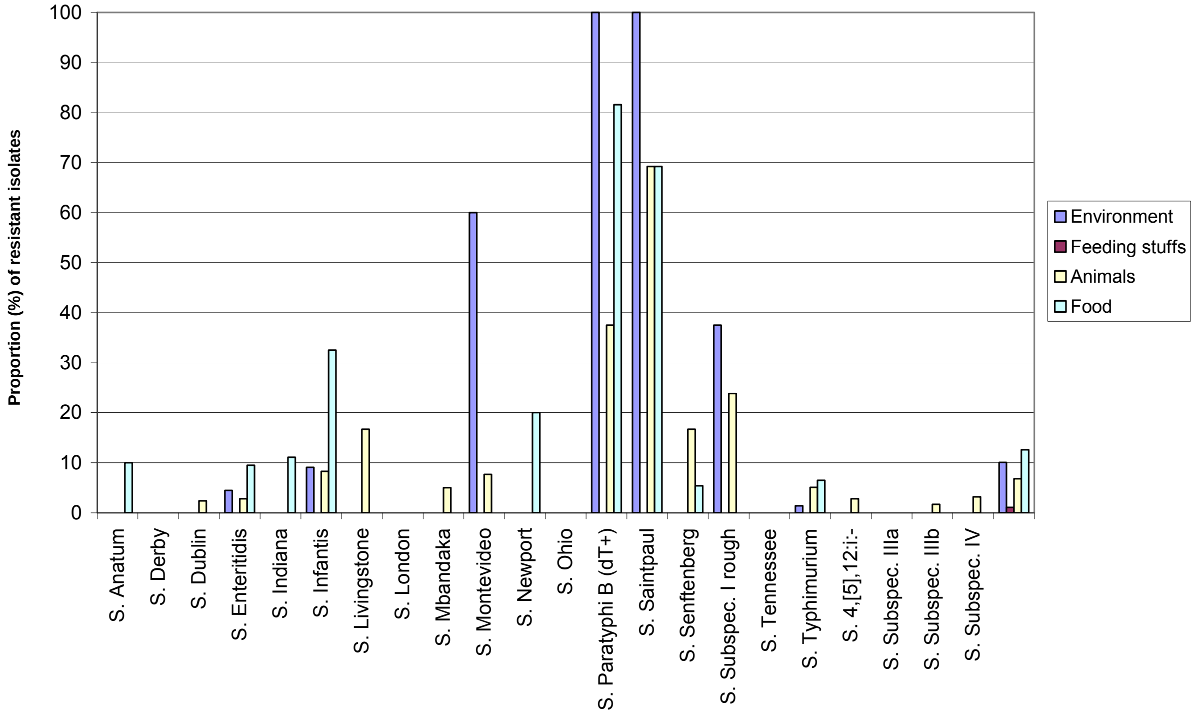


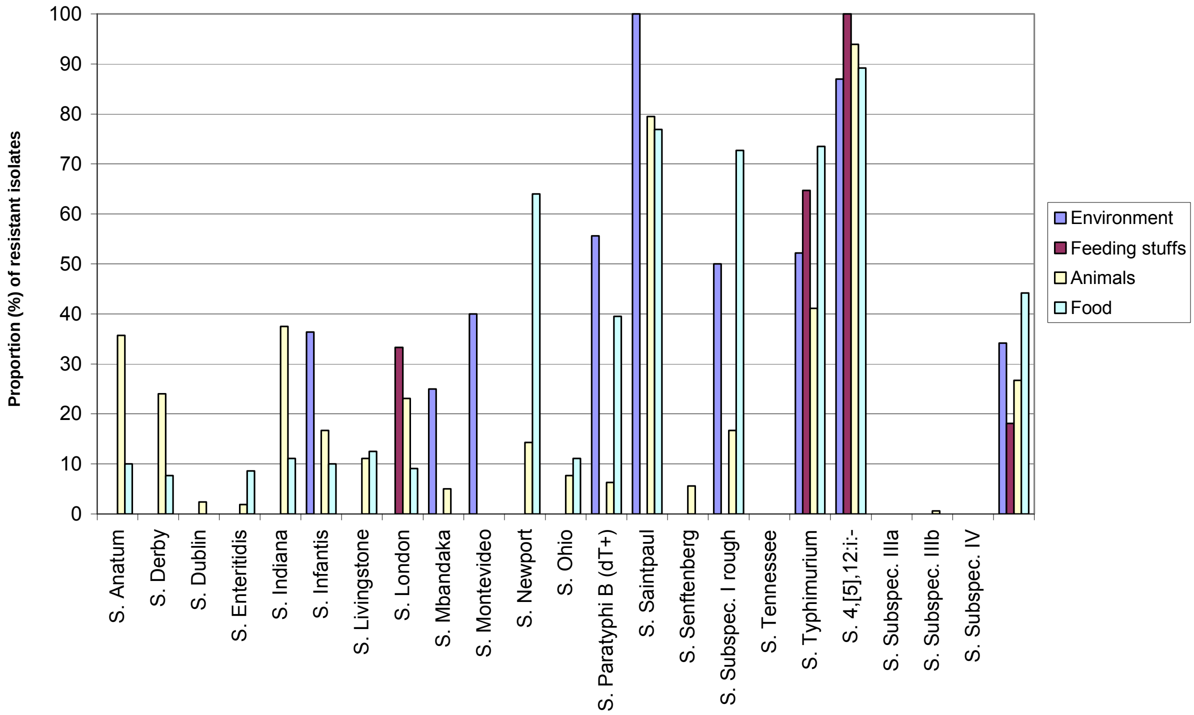
Fig. 4.25: Resistance rates to ciprofloxacin in the 20 most frequent *Salmonella* serovars (2009)



4.4.5 Aminopenicillins

Figure 4.26 shows the rates of resistance to ampicillin among the various serovars. As in previous years, very high rates of resistance (> 50 %) are evident, especially in *S.* Saintpaul, *S.* Typhimurium and *S.* 4,[5],12:i.-. High resistance rates to ampicillin were also obvious in *S.* Paratyphi B dT+, *S.* Newport and *S.* Subspecies I rough.

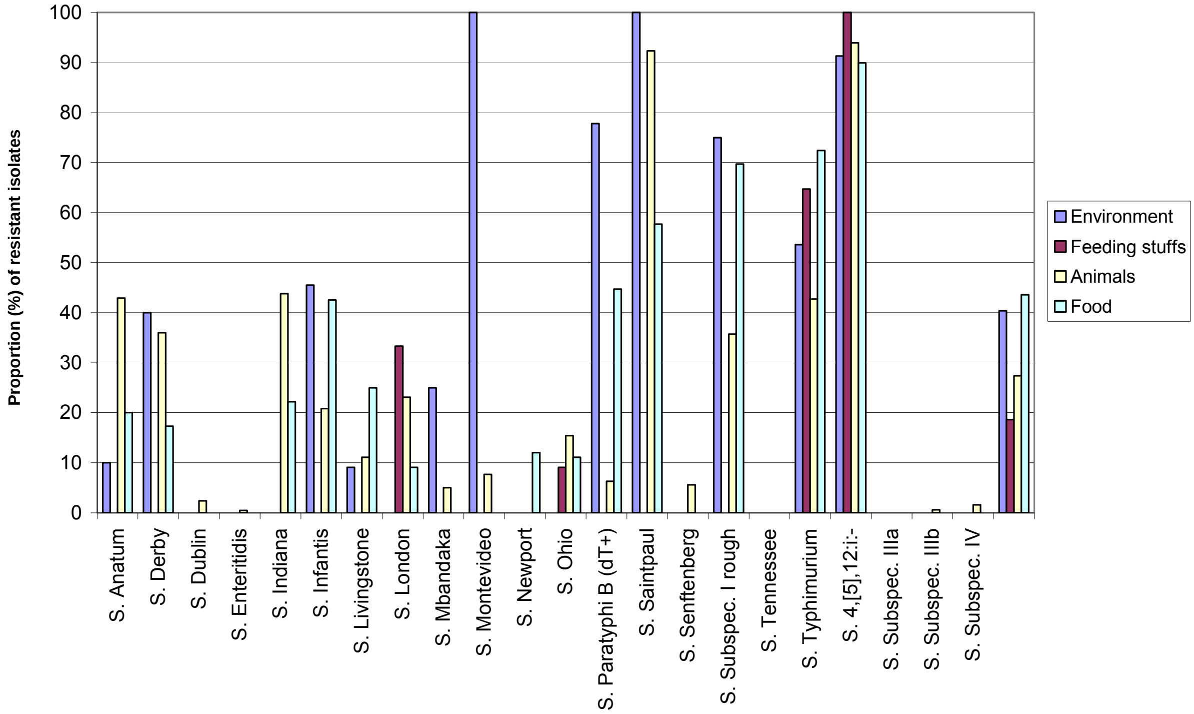
Fig. 4.26: Resistance rates to ampicillin in the 20 most frequent *Salmonella* serovars (2009)



4.4.6 Folic acid synthesis inhibitors

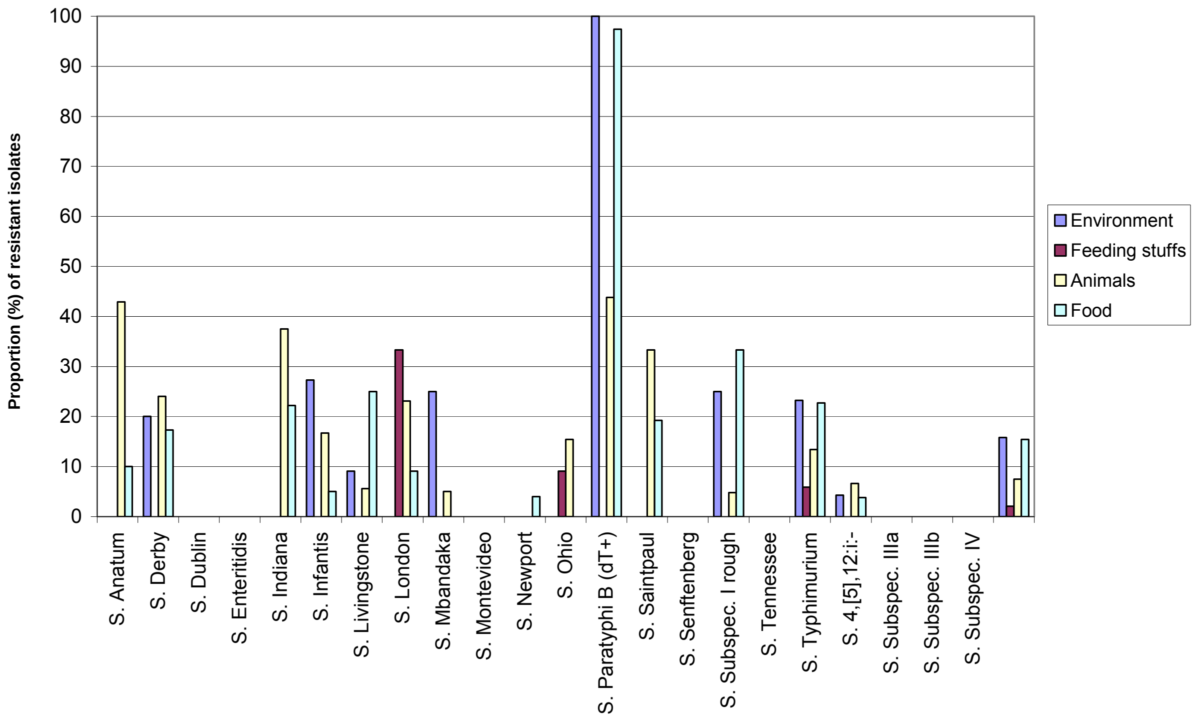
Figures 4.27 and 4.28 show resistance rates to sulfamethoxazole and trimethoprim among the various serovars. As in previous years, there are distinct differences between the serovars concerning sulfamethoxazole. Very high resistance rates were detected in *S.* Paratyphi B dT+, *S*. Saintpaul, *S.* Subspec. I rough*, S.* Typhimurium and its monophasic variant *S.*4,[5],12:i:-. It is remarkable that all five *S*. Montevideo isolates from environmental samples were resistant to sulfamethoxazole.

Fig. 4.27: Resistance rates to sulfamethoxazole in the 20 most frequent *Salmonella* serovars (2009)



Compared with the situation for sulfamethoxazole, considerably lower resistance rates were observed to trimethoprim in the majority of serovars. Some extremely high resistance rates were determined once again for *S*. Paratyphi B dT+ (9 isolates from environmental samples and 38 from food samples). Several other serovars showed resistance in isolates from specific origins.

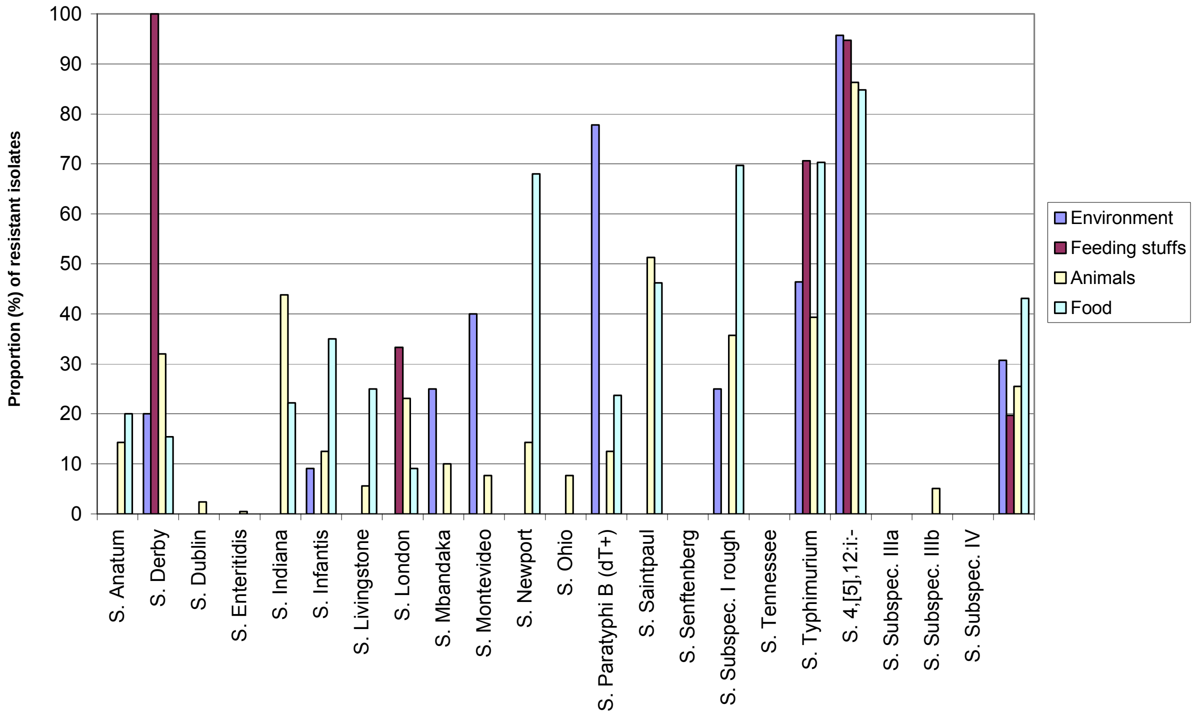
Fig. 4.28: Resistance rates to trimethoprim in the 20 most frequent *Salmonella* serovars (2009)



4.4.7 Tetracyclines

Figure 4.29 shows the resistance rates of the various serovars to tetracycline. Some very high resistance rates were observed here in *S.* Typhimurium and *S.* 4,[5],12:i:-. The only feeding stuff isolate of *S.* Derby also showed resistance to tetracycline. The frequency of resistance to tetracycline in *S.* Newport isolates from food (25 isolates) and *S.* Paratyphi B dT+ isolates from environmental samples (9 isolates) is remarkable.

Fig. 4.29: Resistance rates to tetracycline in the 20 most frequent *Salmonella* serovars (2009)



5 Resistance situation in *Salmonella* isolates from livestock

5.1 Isolates from animals

5.1.1 Origin of isolates

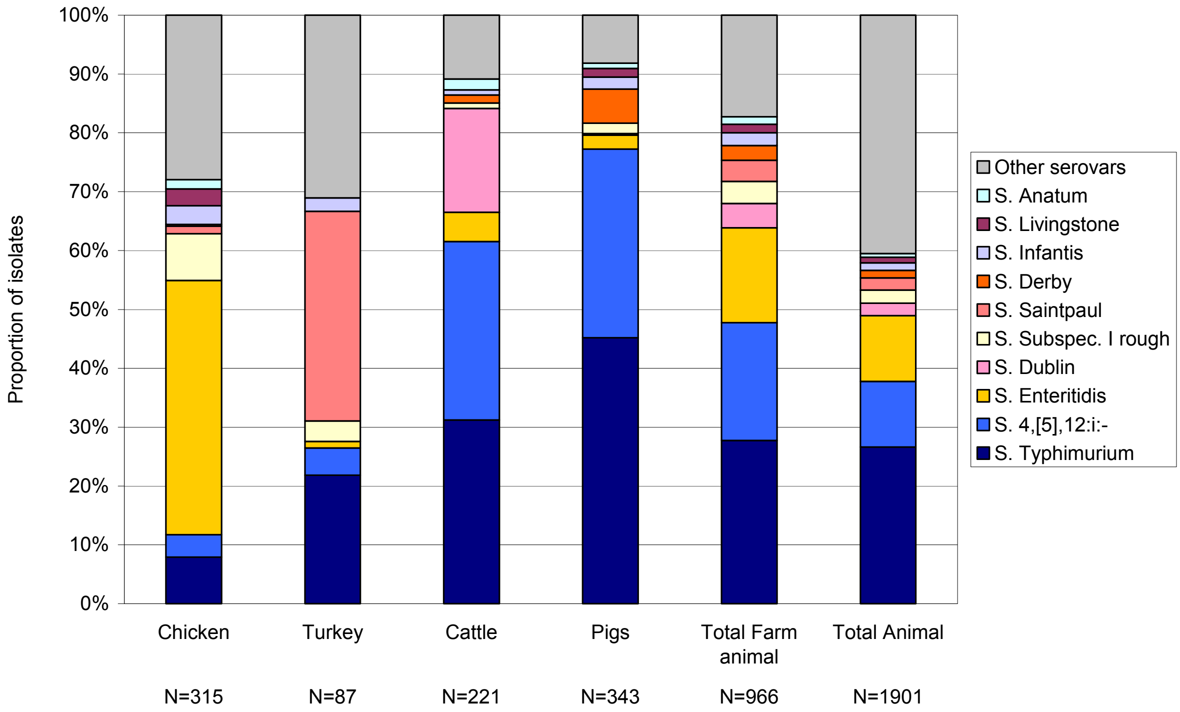
A total of 1,901 isolates of *Salmonella* spp. obtained from animals were submitted to the NRL-Salm in 2009. Of these isolates, 966 (50.8 %) originated from the four livestock species cattle (221; 11.6 %), pigs (343; 18.0 %), chickens (315; 16.6 %) and turkey (87; 4.6 %). The other half of the isolates originated either from other livestock species (sheep, goats, other poultry varieties) or from zoo/sanctuary animals and household pets.

5.1.2 Serovars

The predominant serovar from animals was *S*. Typhimurium (506 isolates, 26.6 %), followed by *S*. Enteritidis and the monophasic serovar *S.* 4,[5],12:i:- (Figure 5.1). The proportion of these three types was slightly higher in the four livestock species with distinct differences between all four. All of the other serovars each accounted for a proportion of less than 5 % of the isolates in the evaluation of the four livestock species.

S. Typhimurium was the predominant serovar in pigs (45.2 %) and cattle (31.2 %) in particular. The monophasic serovar *S.* 4,[5],12:i:- which is closely related to *S.* Typhimurium, was also very common in these two species (32.1 and 30.2 % respectively). The two serovars together made up 77.3 % (pigs) and 61.5 % (cattle) of the isolates. The dominant serovar was *S.* Enteritidis (43.2 %) in chickens, and *S.* Saintpaul (35.6 %) and *S.* Typhimurium (21.8 %) in turkeys. As in previous years, there was a further increase in the proportion of the monophasic serovar *S.* 4,[5],12:i:- in 2009. The outstanding significance of *S.* Saintpaul in turkeys and *S.* Enteritidis in chickens also confirms the findings of the previous years.

Fig. 5.1: Proportions of the ten most frequent serovars among the isolates from animals and the four main livestock species (2009)



5.2 Cattle

5.2.1 Serovars

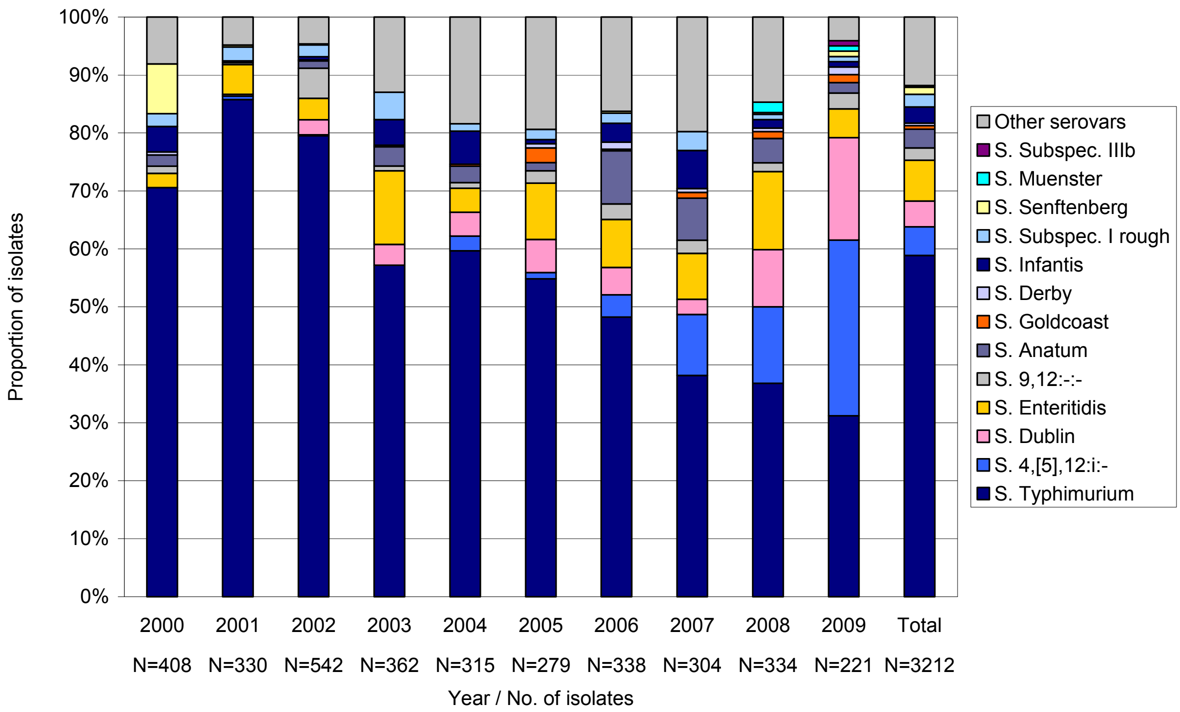
Most of the 221 submitted *Salmonella* isolates from cattle were identified as *S.* Typhimurium (31.2 %). The second most common serovar was *S.* 4,[5],12:i:- with 30.3 %, followed by *S.* Dublin (17.6 %) and *S.* Enteritidis (5.0 %).

Salmonellosis in cattle is a notifiable animal disease. As the responsible federal institution, the Friedrich-Loeffler Institute for Animal Health (FLI), which also houses the National Reference Laboratory for Salmonellosis in Cattle, is involved in the control of notifiable animal diseases. For this reason, part of the Salmonella detected in cattle in the German federal states is sent to this institute. These isolates have not been taken into account in this report. The FLI reports every year in the Animal Health Report[1] on the involvement of Salmonella in the outbreaks. *S.* Typhimurium was also the most frequently identified serovar in the FLI data published for 2009, which covered 81 recorded outbreaks. The proportion of *S.* Typhimurium in the FLI data was similar (38.3 %) to the submissions to the NRL Salm. The proportion of *S.* Dublin was similar too, whereas *S.* Enteritidis accounted for a slightly higher proportion in the outbreaks (9.9 %). The serovar *S.* Abony, which also appeared several times in the outbreaks, was only rarely submitted to the NRL Salm (n=1), while the serovar *S.* 4,[5],12:i:- was not registered when outbreaks occurred.

5.2.2 Trend of the serovars

The declining trend of *S.* Typhimurium in recent years continued in 2009 (Fig. 5.2). The proportions of the other common serovars shifted significantly compared to 2008. As in 2008, *S.* Dublin (2008: 9.9 %) and *S.* 4,[5],12:i:- (2008: 13.2 %), increased significantly, while the proportion of *S.* Enteritidis dropped (2008: 13.5 %).

Fig. 5.2: Proportions of the ten most frequent serovars among the isolates from cattle (2000–2009)



[1] http://www.fli.bund.de/fileadmin/user_upload/Dokumente/Jahresberichte/TG-JB/FLI_TGJB_2008_web.pdf

5.2.3 Serovar resistance

A total of 52.0% of the *Salmonella* isolates from cattle were resistant and 47.9 % were multiresistant (Fig. 5.3). Most of the multiresistant isolates were resistant to four classes of antimicrobials. Resistance was found in particular to aminopenicillins, aminoglycosides, sulfamethoxazole, and tetracycline (each between 44 and 48 %) (Fig. 5.4).

58.0 % of the isolates of *S.* Typhimurium were resistant, 52.2 % to more than one antimicrobial class. The proportion of isolates with resistance to five substance classes was particularly high here. The groups concerned were aminopenicillins, aminoglycosides, amphenicols, sulfamethoxazole and tetracycline (each between 30 % [amphenicols] and 54 % [sulfamethoxazole]). 11.6 % of the isolates were resistant to trimethoprim. Resistances to nalidixic acid and ciprofloxacin (10 % respectively) were observed much more frequently than the previous year (1.6 %) and the long-term average (4.1 %). Resistance to third generation cephalosporins, on the other hand, was not observed, as in 2007 and 2008. Contrary to this, several isolates that were resistant to ceftiofur had been observed in the period 2000–2006.

All but two of the 67 isolates of the serovar *S.* 4,[5],12:i:- were multiresistant (97 %). The substance classes that also showed the highest overall resistances with Salmonella from cattle were predominant. The resistance rates in *S.* 4,[5],12:i:- were between 92 and 97 % for these classes. Unlike *S.* Typhimurium, resistances to amphenicols were not observed. Five isolates were resistant to (fluoro)quinolones, one to third generation cephalosporins. All other resistances were <5 %.

As with the other livestock species, *S.* Enteritidis was considerably less often resistant to antimicrobial substances than *S.* Typhimurium or *S.* 4,[5],12:i:-. Only 6 % of the isolates were resistant and the highest rate of resistance was 3.5 % to sulfamethoxazole.

S. Infantis, *S.* Anatum and *S.* Dublin isolates were also seldom resistant (14.9 %, 9.3 % and 7.0 % respectively) and only multiresistant to a small extent (3.2 %, 3.7 % and 3.5 %). Resistances to (fluoro)quinolones occurred with all three serovars sporadically.

Fig. 5.3: Resistance of selected *Salmonella* serovars from cattle and pigs (2009). Number of classes of antimicrobials the isolates were resistant to

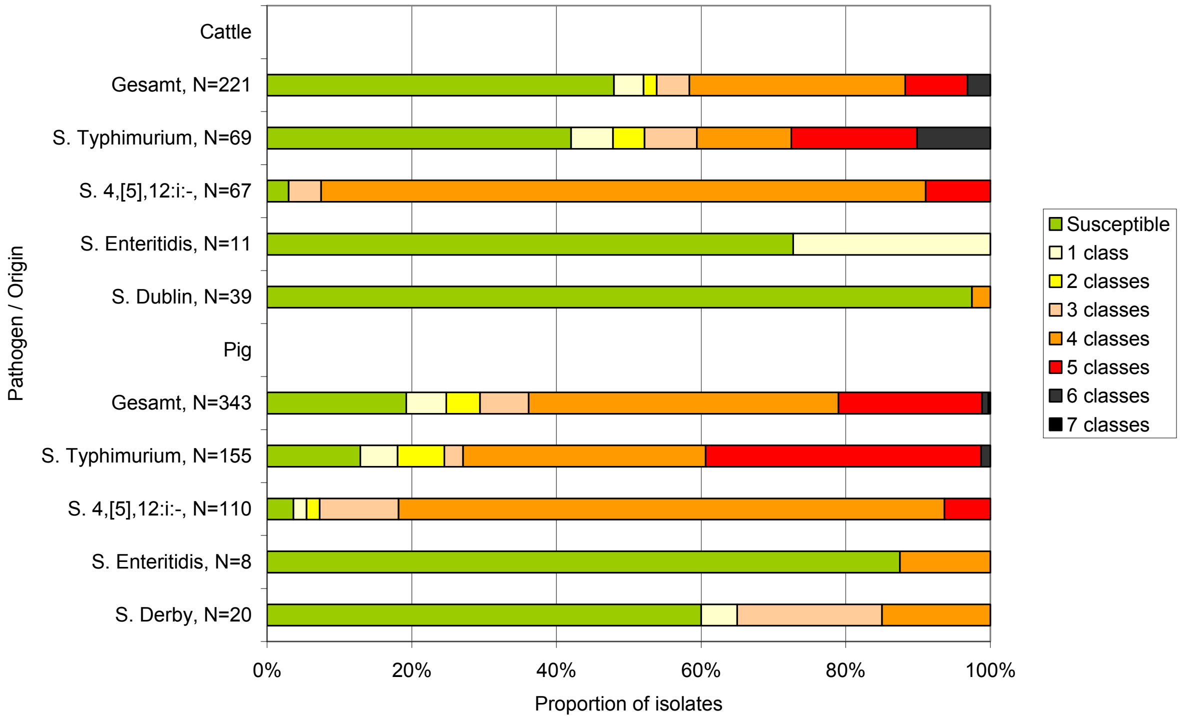
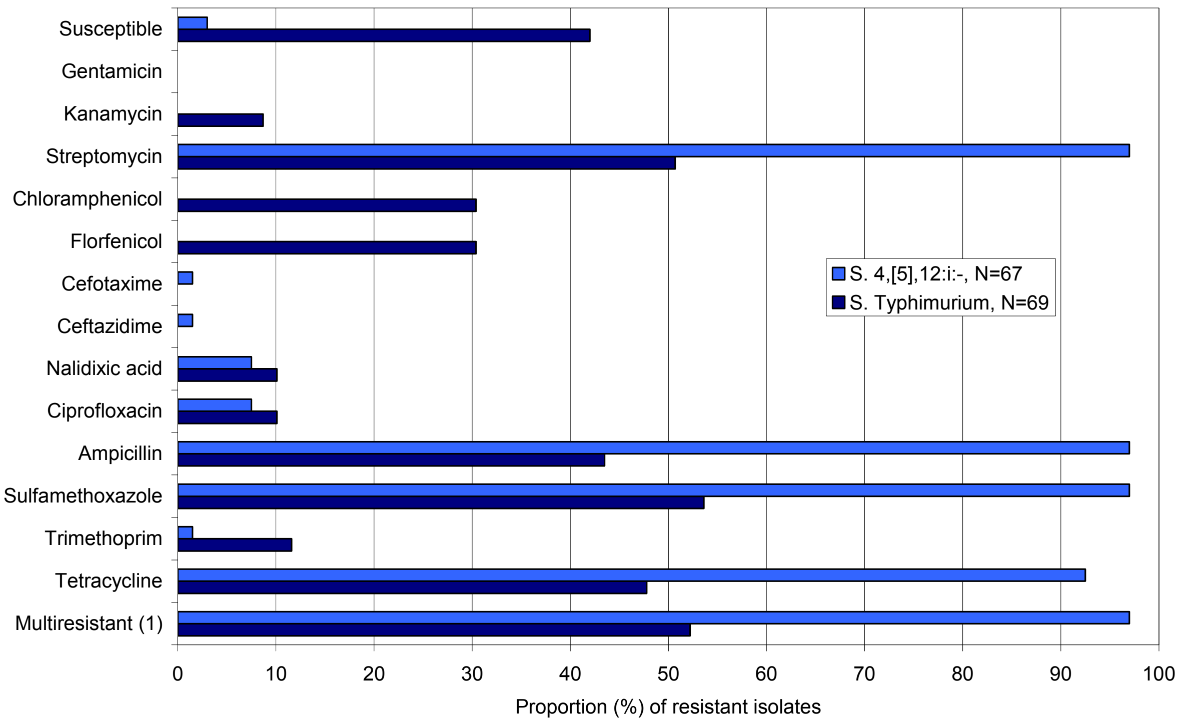
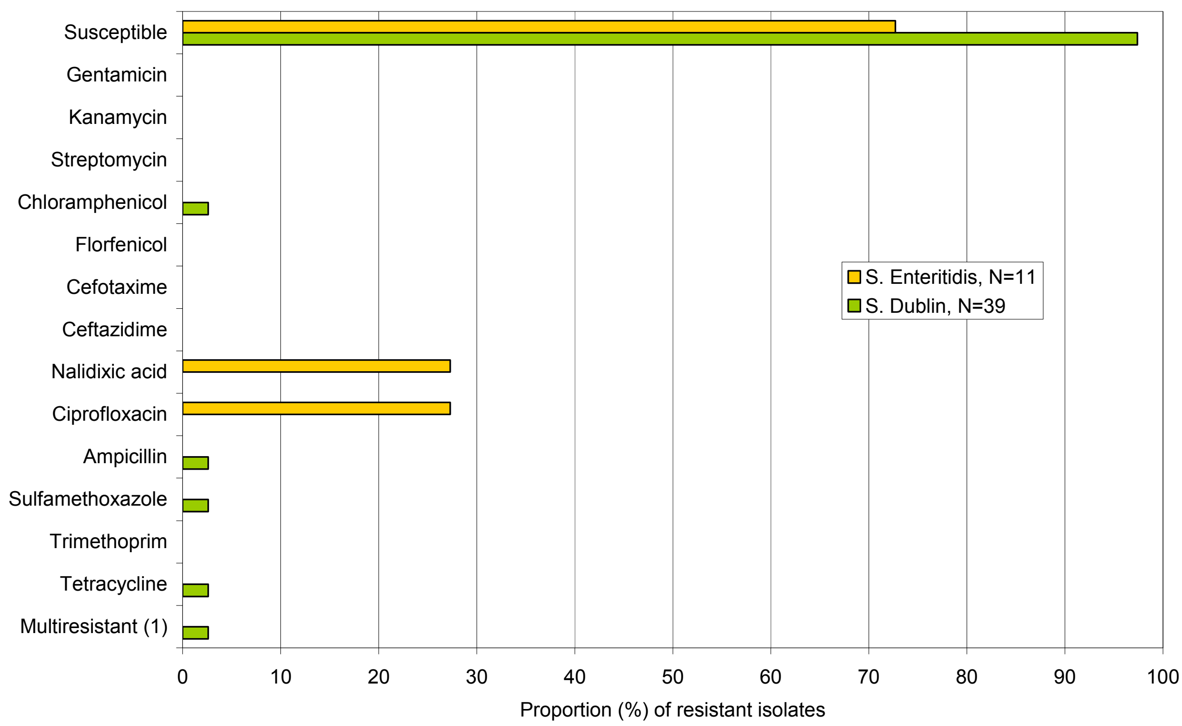


Fig. 5.4: Resistance of selected *Salmonella* serovars from cattle to antimicrobial substances (2009)





(1) Multiresistant = resistant to more than one class of antimicrobials

5.2.4 Trend of resistance

The percentage of resistant *Salmonella* isolates from cattle decreased over the years from 86.5 % in 2000/2001 to 40.0 % in 2007/2008. This change is partly due to the decrease in the proportion of *S.* Typhimurium, although changes in the serovar *S.* Typhimurium occurred as well. The proportion of resistant isolates fell from 94.6 % (2000/2001) to 64.4 % (2007/2008). At the same time, the proportion of multiresistant isolates decreased from 84.4 % to 59.0 %. Resistance to amphenicols and sulfamethoxazole declined.

5.3 Pigs

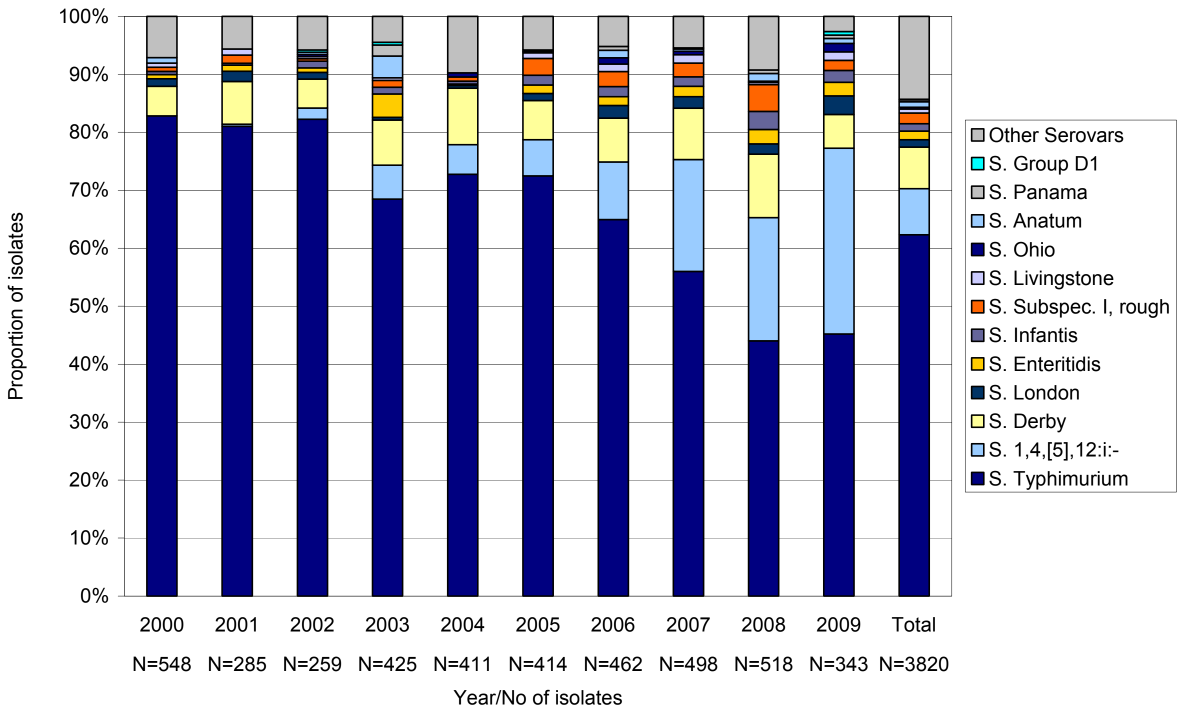
5.3.1 Serovars

Most of the 343 Salmonella isolates from pigs submitted and investigated in 2009 were *S.* Typhimurium (45.2 % of the isolates, Fig. 5.5). The monophasic serovar *S.* 4,[5],12:i:- (32.1 %) was also of considerable importance in pigs. The serovars *S.* Derby (5.8 %) and *S.* Enteritidis (2.3 %) were only identified in a relatively small percentage of the submitted isolates.

5.3.2 Trend of the serovars

S. 4,[5],12:i:- had not been found in 2000, but since then has been increasingly isolated. From 2008 (21 %), the proportion increased by over 50 % to 32.1 % of the isolates from pigs in 2009. The proportion of *S.* Typhimurium isolates remained constant compared to the previous year (2008: 44 %) with the result that the joint percentage of these two closely related serovars increased significantly from 65.3 % (2008) to 77.3 %, reaching the level of 2006 and 2007. The proportion of the serovars *S.* Derby and *S. enterica* subspecies I rough dropped considerably compared to the previous year (from 11 % to 6 % and from 4.6 % to 1.7 % respectively). The proportion of *S.* Enteritidis remained largely constant.

Fig. 5.5: Proportion of the ten most frequent serovars among the isolates from pigs (2000–2009)



5.3.3 Serovar resistance

80.8 % of the *Salmonella* from pigs showed resistance to at least one antimicrobial substance and 75 % of the *Salmonella* were multiresistant (Fig. 5.3). The high percentage of resistant isolates is due to the resistances of *S.* Typhimurium and *S*. 4,[5],12:i:- which made up the largest proportion of the isolates. *S.* Typhimurium and *S*. 4,[5],12:i:- had resistance rates of 87.1 % and 96.4 % respectively and a multiresistance rate of 81.9 % and 94.6 % respectively, whereas only 40 % and 35 % of *S.* Derby were resistant and multiresistant, respectively. Of the eight isolates of *S.* Enteritidis, seven were susceptible and one resistant to four substance classes (streptomycin, ampicillin, sulfamethoxazole and tetracycline).

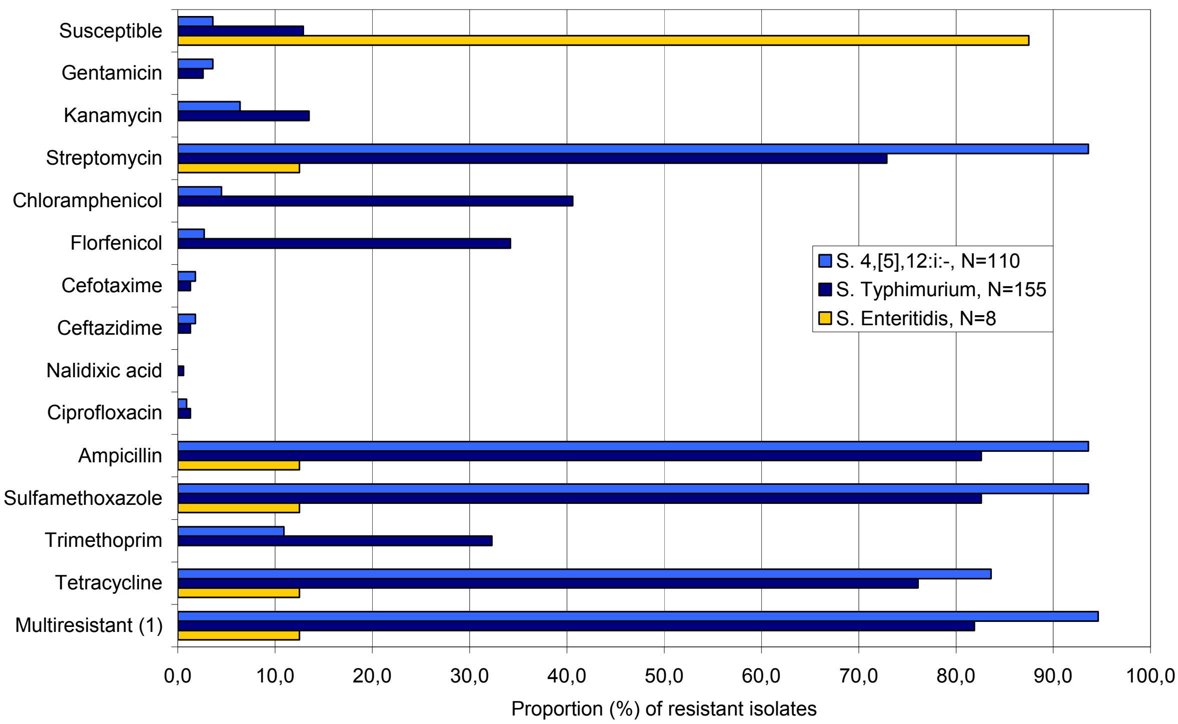
S. Typhimurium was extremely frequently resistant (73–83 %) to ampicillin, streptomycin, tetracycline and sulfamethoxazole (Fig. 5.6). Resistance to amphenicols (34–40 %), trimethoprim (32 %) and kanamycin (13 %) was detected less frequently. Two isolates were resistant to third generation cephalosporins and (fluoro)quinolones.

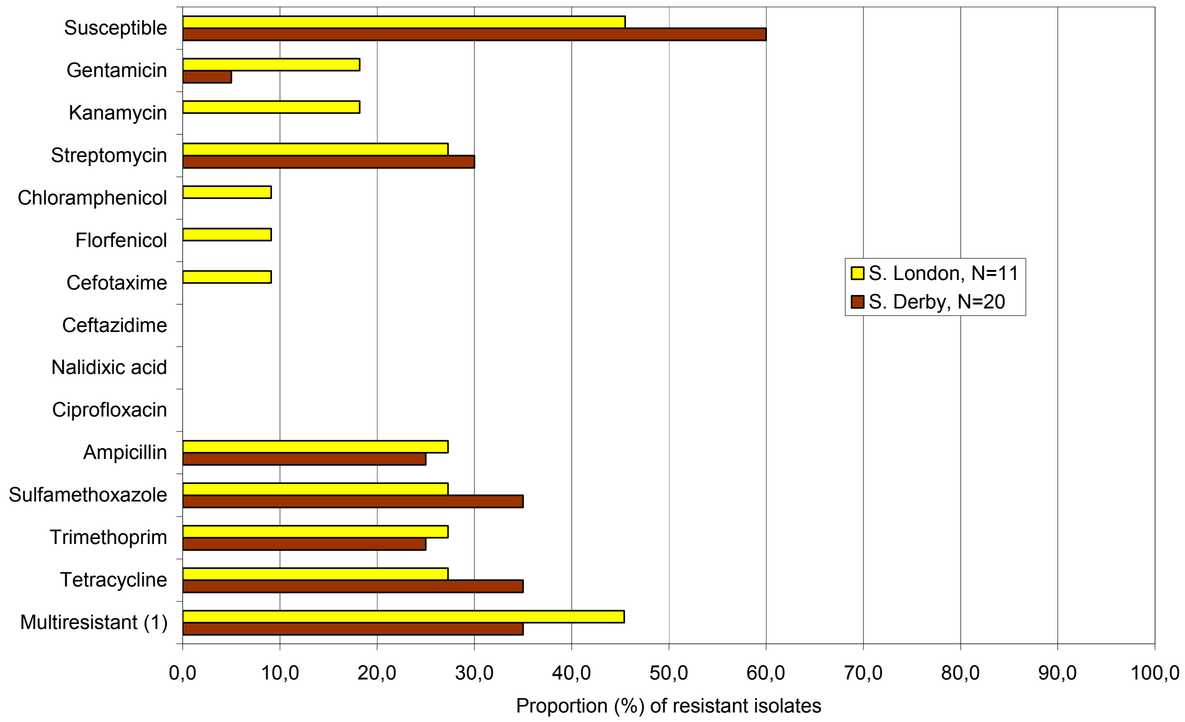
The resistance situation in the monophasic serovar *S.* 4,[5],12:i:- was very similar to that of *S.* Typhimurium. Only a few isolates showed resistance to cephalosporins (two from 110 isolates, 1.8 %) and ciprofloxacin (one isolate). This serovar showed considerably less resistance to amphenicols and trimethoprim than *S.* Typhimurium. The proportion of isolates resistant to streptomycin, ampicillin, sulfamethoxazole and tetracycline, however, was much higher than in *S.* Typhimurium (84–94 %).

S. Derby showed much lower resistance rates than the serovars mentioned above. This was particularly noticeable for ampicillin (25 %), amphenicols (0%), sulfamethoxazole and tetracycline (35 % each), as well as streptomycin (30 %). Four isolates (25 %) proved to be resistant to trimethoprim. Of the 20 *S.* Derby isolates, none showed resistance to quinolones or third generation cephalosporins.

Of the 11 isolates of *S.* London submitted in 2009, six were resistant (55 %) and five multiresistant (46 %). The resistances were distributed over almost all substance classes with the exception of the fluoroquinolones. One isolate was resistant to cefotaxime a third generation cephalosporin.

Fig. 5.6: Resistance of selected *Salmonella serovars* from pigs to antimicrobial substances (2009)





(1) Multiresistant = resistant to more than one class of antimicrobials

5.3.4 Trend of resistance

The proportion of resistant and multiresistant *Salmonella* isolates from pigs (81 and 75 % respectively) was more or less constant compared to the previous year (78 and 68 %). This also applied to *S.* Typhimurium, while the proportion of multiresistant *S.* 4,[5],12:i:- isolates was above 90 % for the first time since 2004 (95 % vs. 88 % in 2008).

The proportion of isolates resistant to the individual substance classes was constant in *S.* Typhimurium with the exception of gentamicin (2.6 % vs. 9.2 % in 2008). In *S.* 4,[5],12:i:- the slight increase of multiresistant isolates was also reflected in the individual substance classes.

S. Derby was considerably less often resistant than in the previous year (40 vs. 74 %), which is attributable above all to the reduced proportion of resistance to tetracycline (35 vs. 60 %). This percentage was varied considerably in the course of the years (between 11 and 60 %).

5.4 Chicken

5.4.1 Serovars

With the 315 isolates from chicken, the production branch from which they originated was not specified in more detail (breeding hen, laying hen or broiler flocks).

S. Enteritidis was the most common serovar in 2009 (45 %) (Fig. 5.7). Other common isolates were *S.* Typhimurium and *S.* Subspec. I rough (8 % each), as well as *S.* 4,[5],12:i:- (4 %) and *S.* Infantis (3 % %). Of the other serovars, fewer than ten isolates per serovar were submitted.

5.4.2 Trend of the serovars

The high percentage of *S.* Enteritidis is in line with the data from the years 2007 (47.1 %) and 2008 (38.5 %). It is not clear, however, whether this is attributable to an actual increase in the percentage of *S.* Enteritidis in the serovars within the population over the years 2003 to 2006 or whether it is due to increased examinations in laying hens in the scope of the control programme in accordance with Reg. (EC) No. 1168/2006. *S.* Typhimurium, the second serovar to be considered in the control programmes for laying hens and broilers (Reg. [EC] No. 646/2007) did not show an increase of this kind. This serovar also becomes less common in laying hens within the scope of the control programmes and is not detected as often in broilers as in cattle and pigs. *S.* 4,[5],12:i:- was not among the most common serovars from chicken in the past either, but it is sometimes detected in broilers and chicken meat. Contrary to this, *S.* Infantis was always one of the most common serovars in the past (2000–2008: 7.6 %) and is covered by the *Salmonella* control programme for breeding poultry (Reg. [EC] No. 1003/2005). The serovars *S.* Hadar and *S.* Virchow are also covered by the control programmes for breeding poultry but were only rarely submitted to the NRL Salm (two and one isolates respectively). The previously common serovar *S.* Paratyphi B dT+ was also only submitted rarely within the scope of routine monitoring in 2009.

5.4.3 Serovar resistance

The *Salmonella* isolates from chicken were least frequently resistant (20 %) in comparison with those of other livestock species and also had the lowest multiresistance rate (15.9 %) (Fig. 5.8). The resistant isolates were resistant to roughly 5 % to one to four substance classes. The majority of resistances were to sulfamethoxazole (12 %), tetracycline, streptomycin and ampicillin (10 % each), but 9 % of the isolates were also resistant to ciprofloxacin (Fig. 5.9). Resistance to third generation cephalosporins was not observed with *Salmonella* isolates from chicken in 2009.

The comparatively low resistance rate of *Salmonella* from chicken is attributable to a high proportion of *S.* Enteritidis in the isolates. Apart from one isolate, *S.* Enteritidis isolates were highly susceptible to all tested substances. The one isolate showed a resistance to ampicillin.

80 % of the 25 isolates of *S.* Typhimurium were also susceptible, however. The five resistant isolates were all resistant to tetracycline, four of them to ampicilin and sulfamethoxazole and three of them to amphenicols and streptomycin. Two isolates showed a resistance to (fluoro)quinolones. None of the isolates were resistant to third generation cephalosporins.

Contrary to this, only one of the 12 examined isolates of *S.* 4,[5],12:i:- was susceptible. Nine of the 12 isolates showed a quadruple resistance to streptomycin, ampicillin, sulfamethoxazole and tetracycline. None of them were resistant to (fluoro)quinolones or third generation cephalosporins.

Only three out of ten isolates of *S*. Infantis were resistant. Resistances to (fluoro)quinolones and third generation cephalosporins were not observed in this serovar.

Of the 63 resistant *Salmonella* isolates from chicken, only 16 belonged to the serovars *S.* Typhimurium (5) and *S.* 4,[5],12:i:- (11). The other isolates were distributed over a number of other serovars.

Fig. 5.7: Proportions of the ten most frequent *Salmonella serovars* among the isolates from chicken (2000–2009)

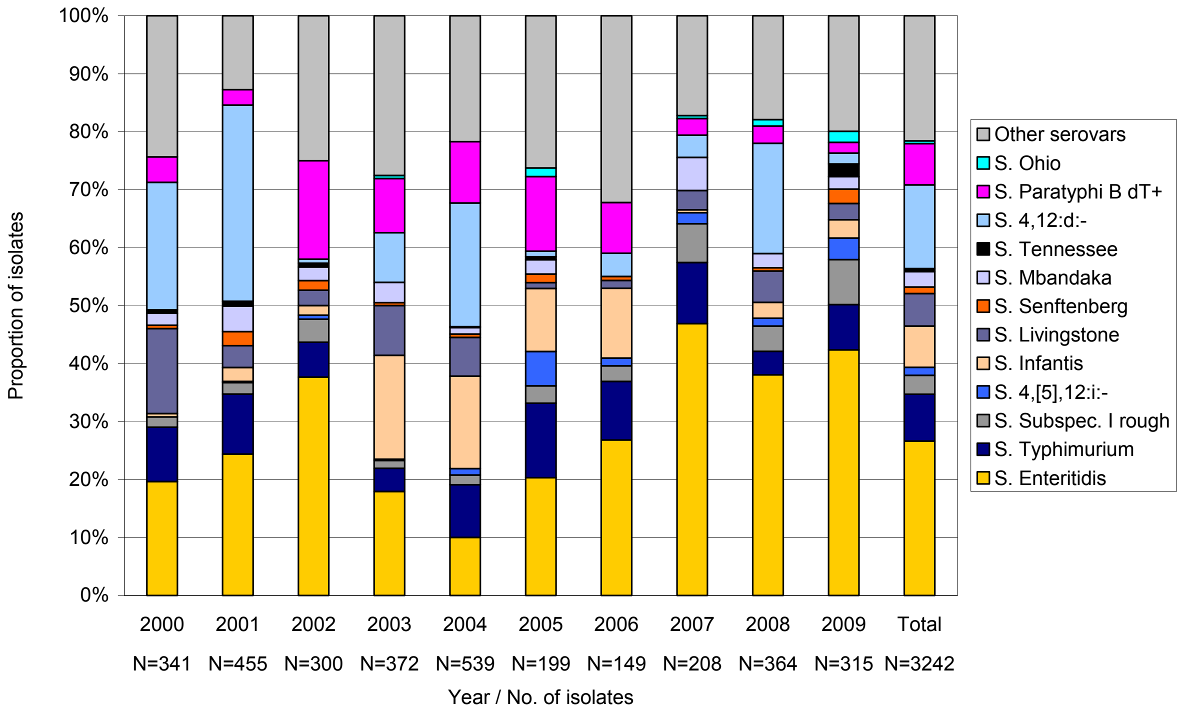


Fig. 5.8: Resistance of selected *Salmonella* serovars from chickens and turkeys (2009); Number of classes of antimicrobials the isolates were resistant to

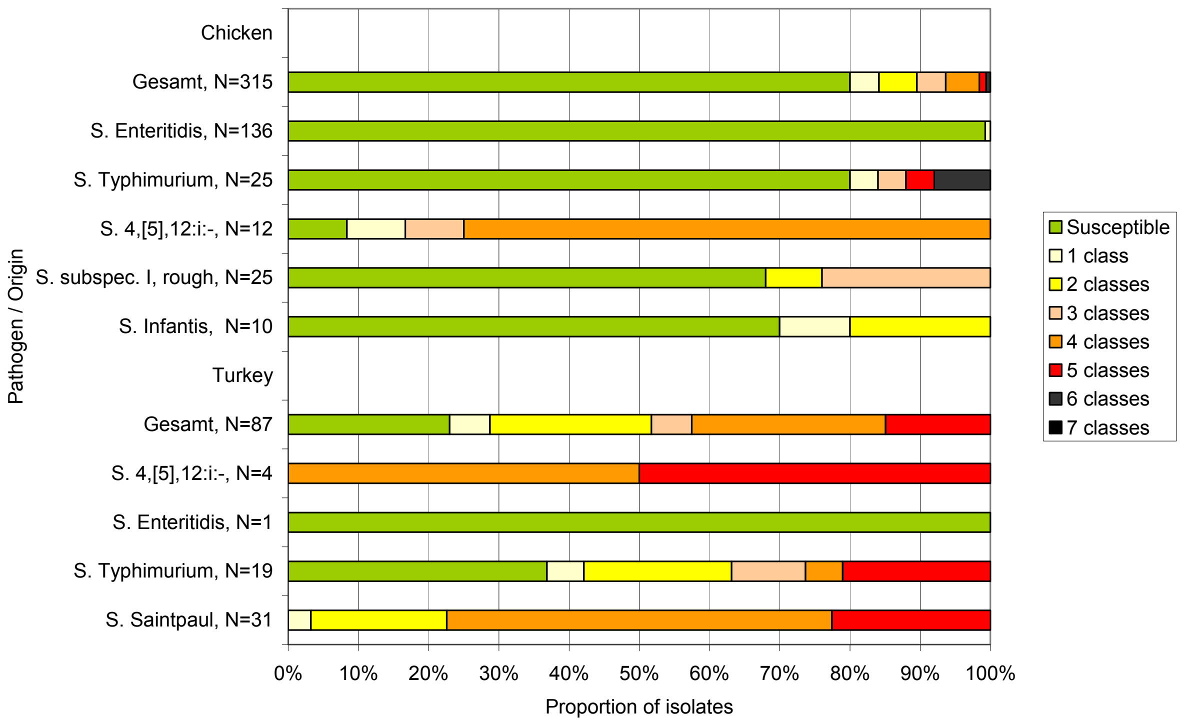
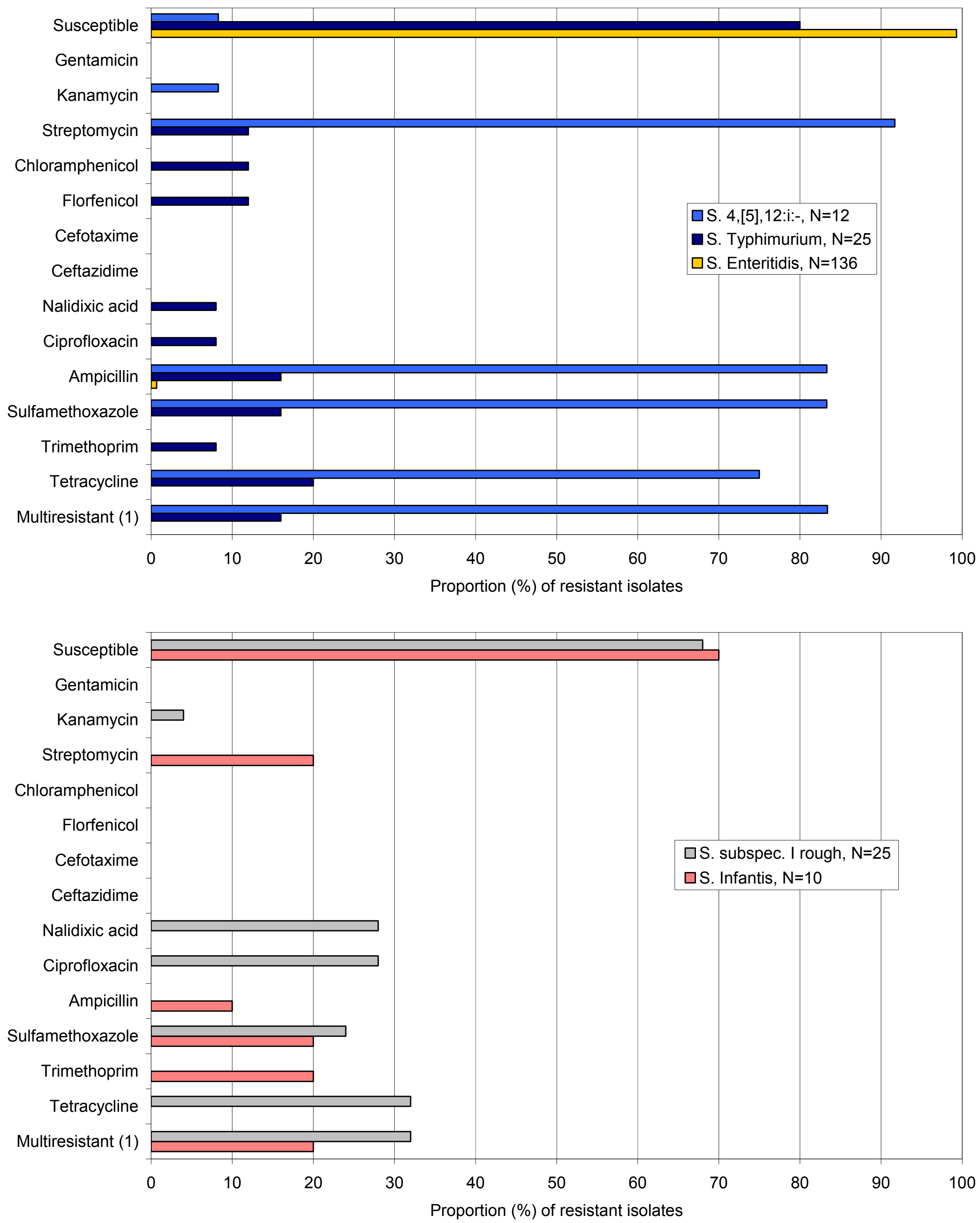


Fig. 5.9: Resistance of selected *Salmonella* serovars from chicken to antimicrobial substances (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

5.4.4 Trend of resistance

Overall, the percentage of resistant *Salmonella* isolates from chicken decreased over the years from 74 % (2000) to 15 % (2008), although there was a slight increase in 2009 (to 20 %). The proportion of multiresistant isolates showed a similar development (drop from 29 % (2000) to 11.3 % (2008) and slight increase to 16 % (2009).

The decline of resistant isolates could also be seen with *S.* Enteritidis although there was no new increase in 2009 and only one single-resistant isolate. The proportion of susceptible isolates from chicken tended to increase in the course of the year with *S.* Typhimurium, but the number of isolates per year was limited so that the validity of trend statements is questionable here.

5.5 Turkey

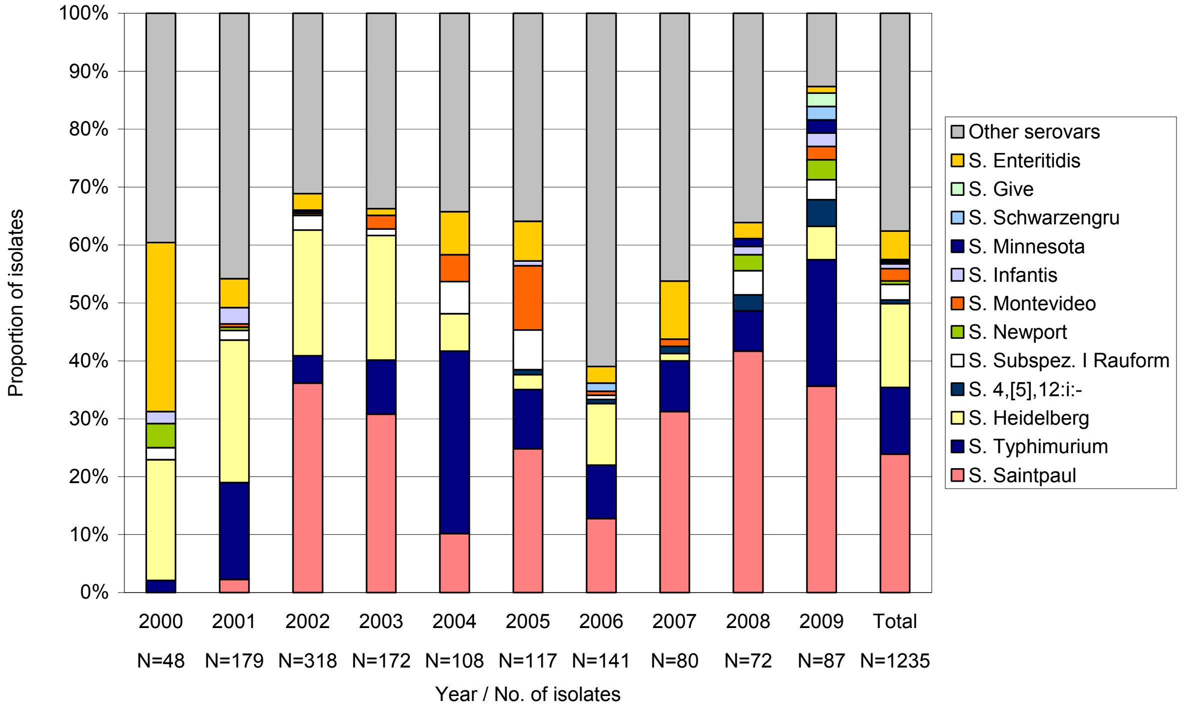
5.5.1 Serovars

The serovar spectrum of the 87 submitted *Salmonella* isolates from turkeys differed from chickens as well as cattle and pigs. *S.* Saintpaul was submitted most often from turkeys (35.6 %) (Fig. 5.10). Otherwise, more than ten isolates were only submitted from *S.* Typhimurium (19 isolates, 21.8 %). *S.* Enteritidis (one isolate) and the monophasic serovar *S.* 4,[5],12:i:- (four isolates) accounted for less than 5 % of the isolates.

5.5.2 Trend of the serovars

The high percentage of *S.* Saintpaul is in line with the results of the last two years (2007: 31 %, 2008: 42 %). The percentage of *S.* Typhimurium was above the long-term average and the values for 2007 and 2008. The serovar *S.* Heidelberg, which was common in the years 2000–2003 in particular, was identified in five isolates, which was more than in the years 2007 and 2008. The individual detection of *S.* Enteritidis complies with the data of the previous years.

Fig. 5.10: Proportions of the ten most frequent *Salmonella* serovars among the isolates from turkeys (2000–2009)



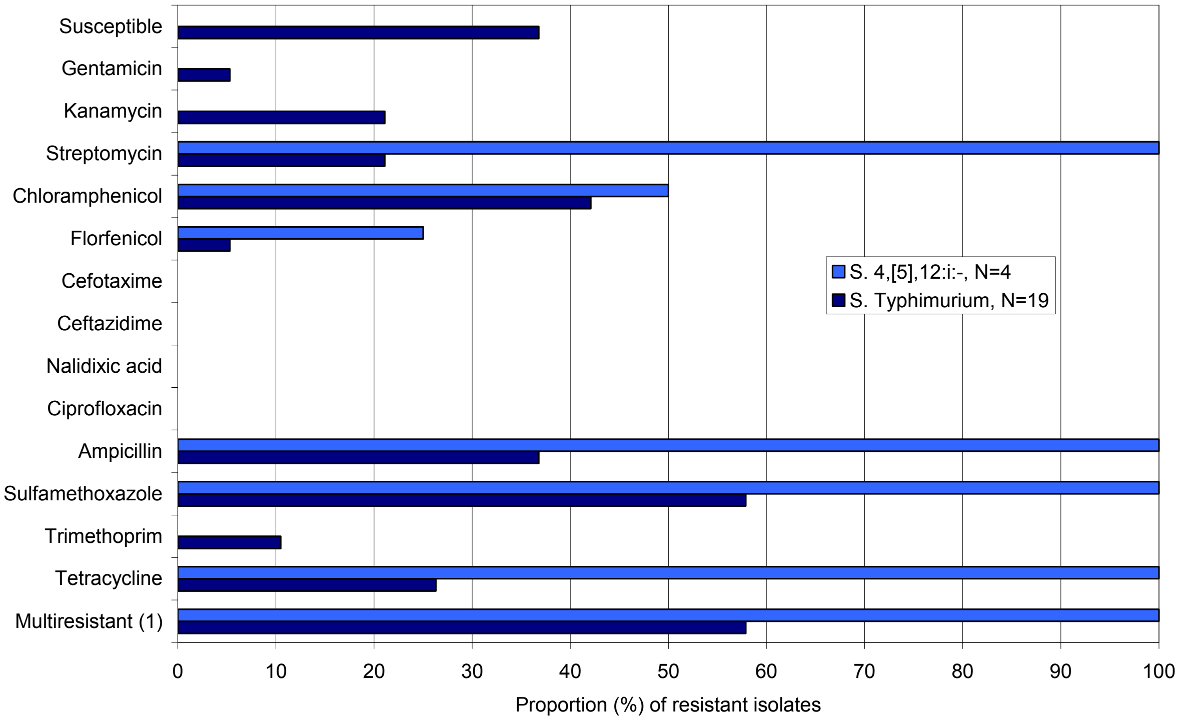
5.5.3 Serovar resistance

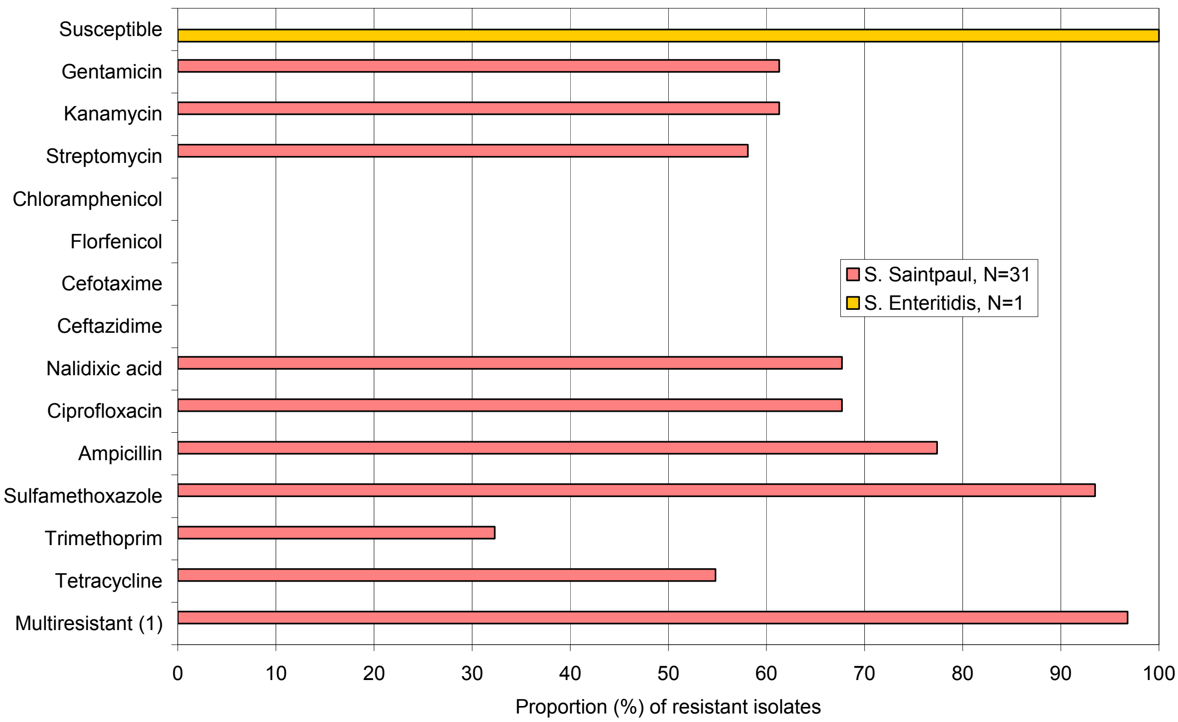
A total of 77 % of the *Salmonella* isolates from turkeys were resistant and 71 % were multiresistant (Fig. 5.8). Resistance to sulfamethoxazole (59 %), ampicillin (58 %) and tetracycline (47 %) was detected most frequently. Roughly 30 % of the isolates were resistant to the aminoglycoside and fluoroquinolones. No resistance to third generation cephalosporins were detected.

The serovar *S.* Saintpaul had the highest resistance rates. All isolates were resistant to at least one of the substance classes and 97 % to more than one. Resistance to sulfamethoxazole (94 %) and ampicillin (77 %) was most common in *S.* Saintpaul. Resistance to fluoroquinolones (67 %) was more common in *S.* Saintpaul than resistance to aminoglycosides (61 %) and tetracycline (55 %). No resistances to the amphenicols and third generation cephalosporins were determined in *S.* Saintpaul.

S. Typhimurium from turkeys proved to be less often resistant than *S.* Saintpaul. This applied to all substance classes except the amphenicols, where 42 % of the *S.* Typhimurium isolates showed resistance to chloramphenicol. The isolate of *S.* Enteritidis proved to be completely susceptible.

Fig. 5.11: Resistance of selected *Salmonella* serovars from turkeys to antimicrobial substances (2009)





(1) Multiresistant = resistant to more than one class of antimicrobials

5.5.4 Trend of resistance

Overall, the resistance situation in *Salmonella* from turkeys towards the various antimicrobial substances complied with the long-term average. The extremely high resistance rates for *S.* Saintpaul confirm the examinations from the years 2001–2008, whereas the resistance rates towards many substances were slightly lower in 2009 than on the long-term average or in 2008.

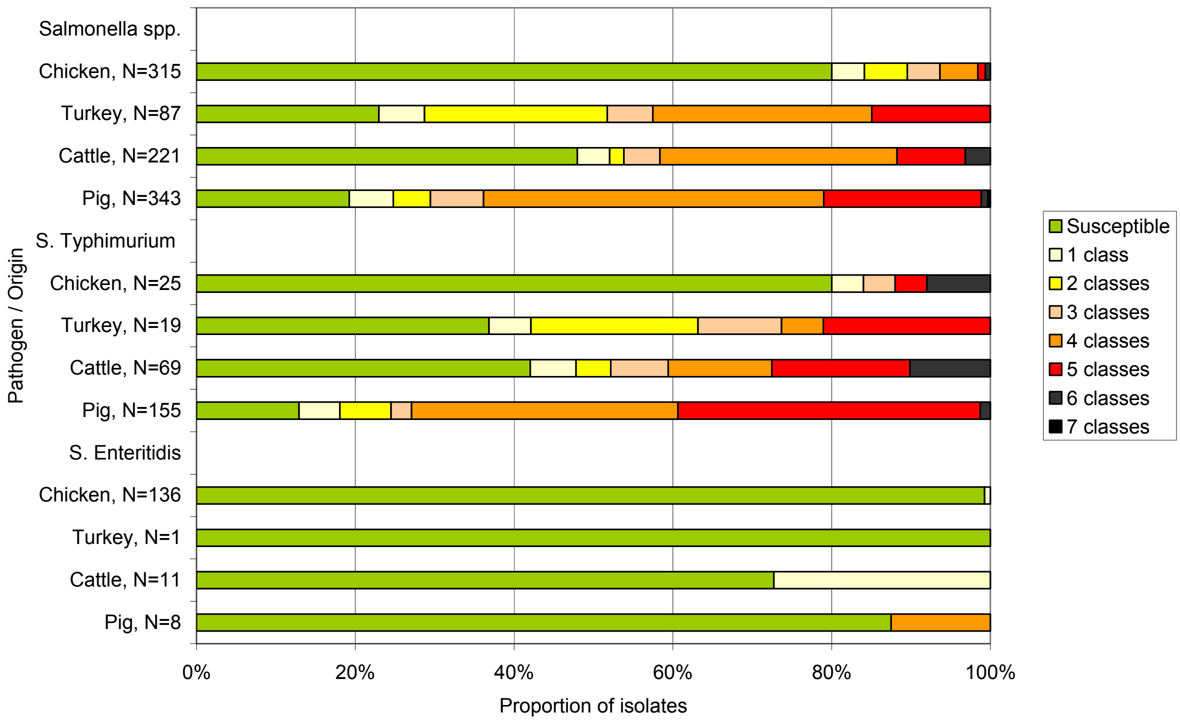
Some of the resistance rates of *S.* Typhimurium were considerably lower than in the past years. An exception to this was gentamicin and kanamycin with higher resistance rates. As only 19 isolates could be investigated, however, the changes in the resistance rates should be evaluated with caution.

5.6 Comparison of the resistance of serovars from different animal species

5.6.1 Salmonella spp.

Overall, *Salmonella* from pigs showed the highest resistance rates (Fig. 5.12). Of the 343 isolates, 81.2 % were resistant to one active substance class and 75.3 % to several classes. This was followed by turkeys (77 % and 71.3 %), cattle (52.0 % and 47.9 %) and the lowest rates of resistance with chickens (20.0 % and 15.9 %). As there were considerable differences both between the proportion of resistant and multiresistant isolates in the serovars as well as in the proportions of the serovars in the different livestock species, a comparison of the resistance rates of specific serovars that occurred in different animal species is presented below.

Fig. 5.12: Resistance rates of *Salmonella* spp. and the serovares *S.* Typhimurium and *S.* Enteritidis in livestock species (2009); Number of classes of antimicrobials the isolates were resistant to



5.6.2 S. Typhimurium

The percentage of resistant isolates of *S.* Typhimurium was highest in pigs (87.1 %), followed by turkeys (63.2 %), cattle (58.0 %) and chicken (20.0 %). Isolates of chicken also showed a considerably lower multiresistance rate (16.0 %) than those of the other three livestock species (52.2 % [cattle] to 81.9 % [pigs]). Whereas the *S.* Typhimurium isolates of cattle and pigs were very often (51 % and 73 % respectively) resistant to streptomycin, the resistance rate was considerably lower in chicken (12 %) and turkeys (21 %) (Fig. 5.13). The rate of resistance to chloramphenicol was much lower in isolates from chicken (12 %) than in isolates from other animal species (30–42 %). Isolates from chicken and cattle, with 8 % and 10 % respectively, were comparatively frequently resistant to the fluoroquinolones, while resistance in *S.* Typhimurium from pigs was rare (1.3 %) and was not observed at all in turkeys. *S.* Typhimurium from cattle, turkeys and chicken did not show any resistance to third generation cephalosporins during the investigated period. In pigs, the resistance rate to this substance class was 1.3 % (two isolates).

Fig. 5.13: Comparison of the resistance rates of *S.* Typhimurium from cattle, pig, chicken and turkey to antimicrobial substances (2009)

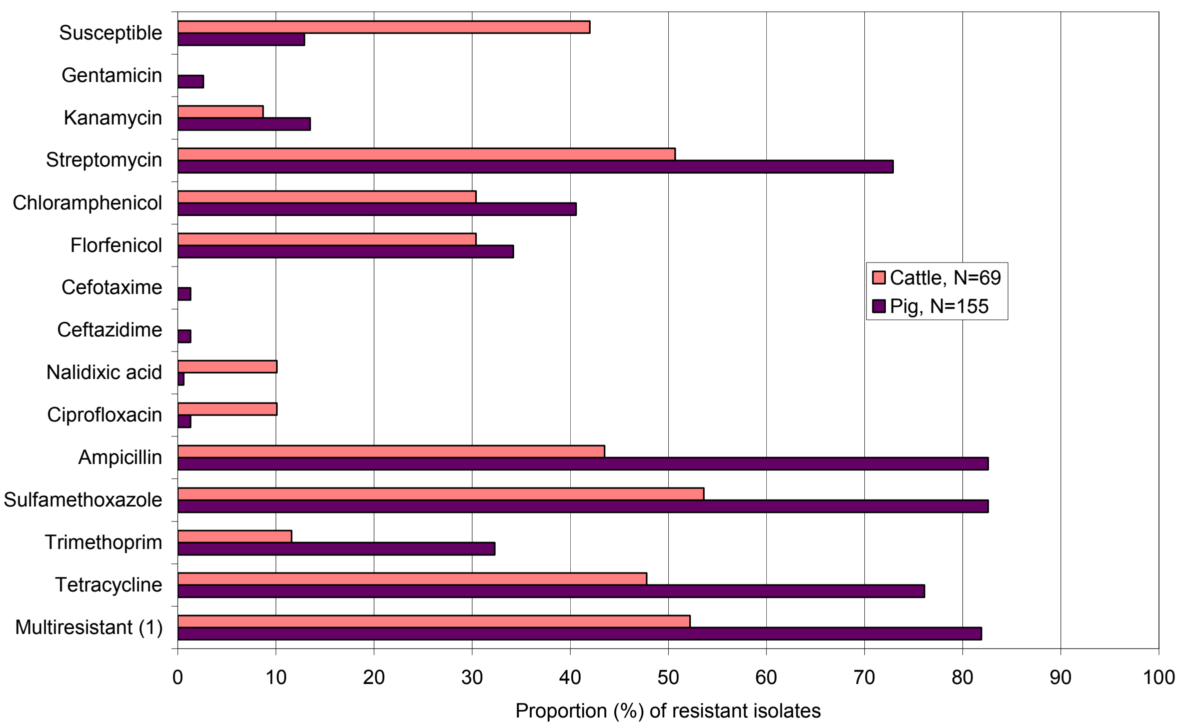
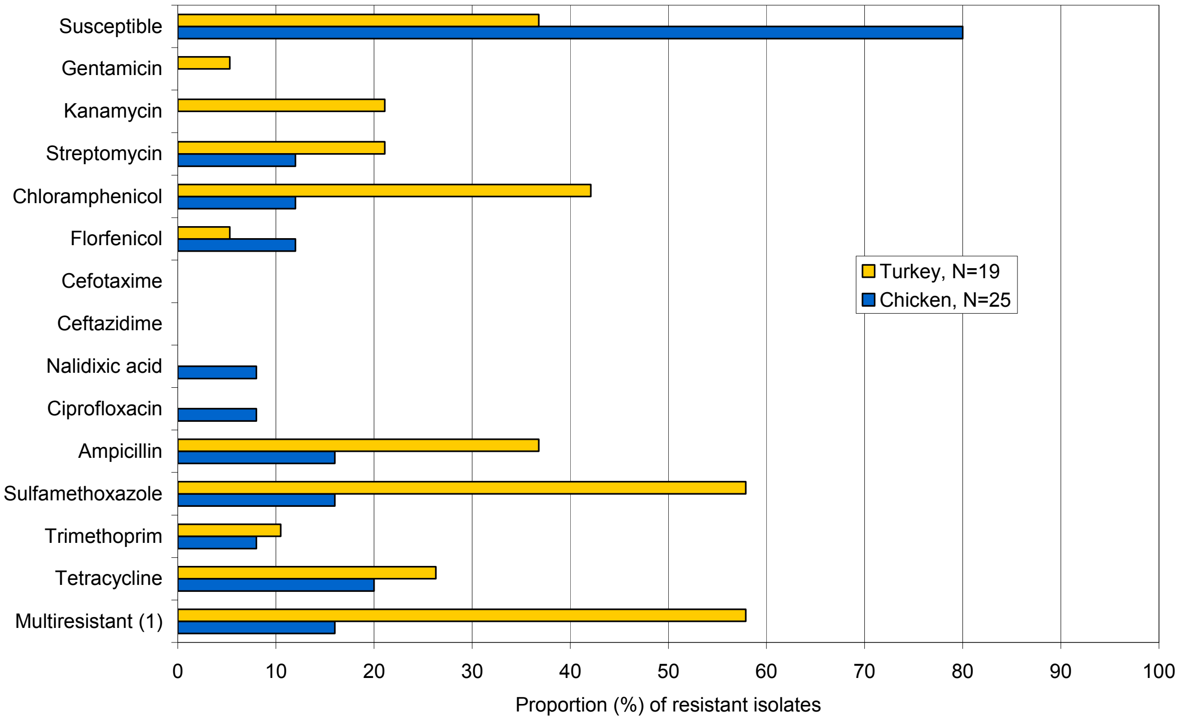


Fig. 5.13: Comparison of the resistant rates of *S.* Typhimurium from cattle, pig, chicken and turkey to antimicrobial substances (2009) (cont.)

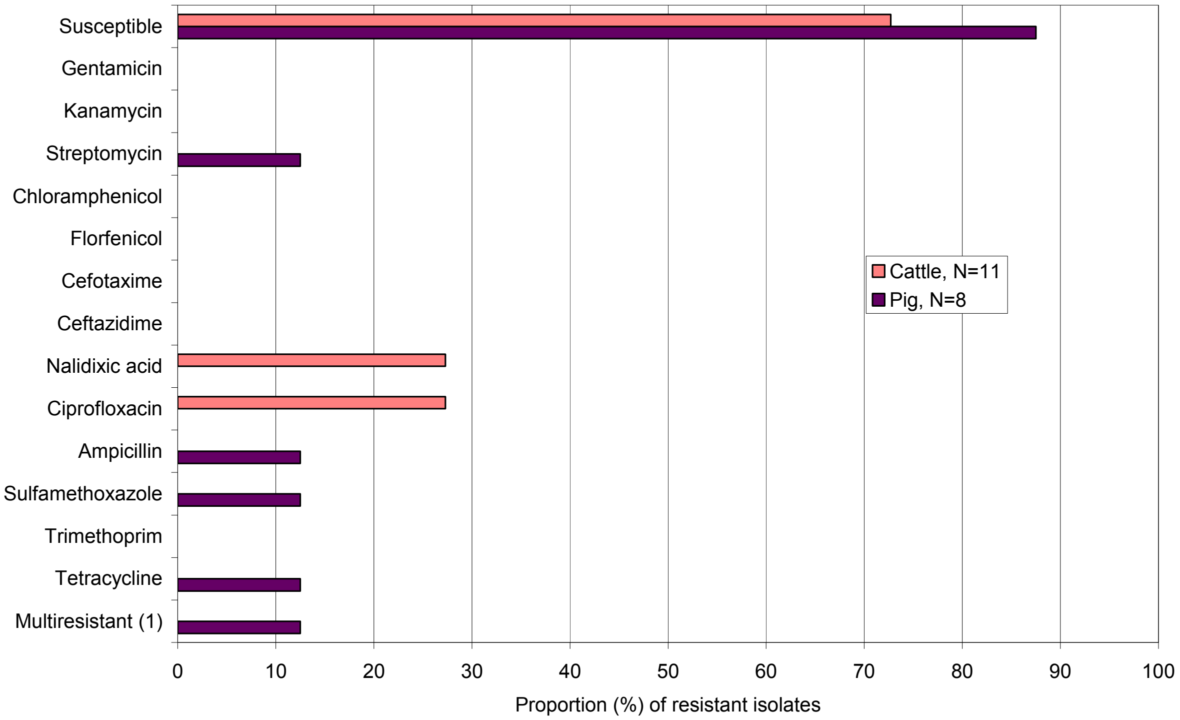


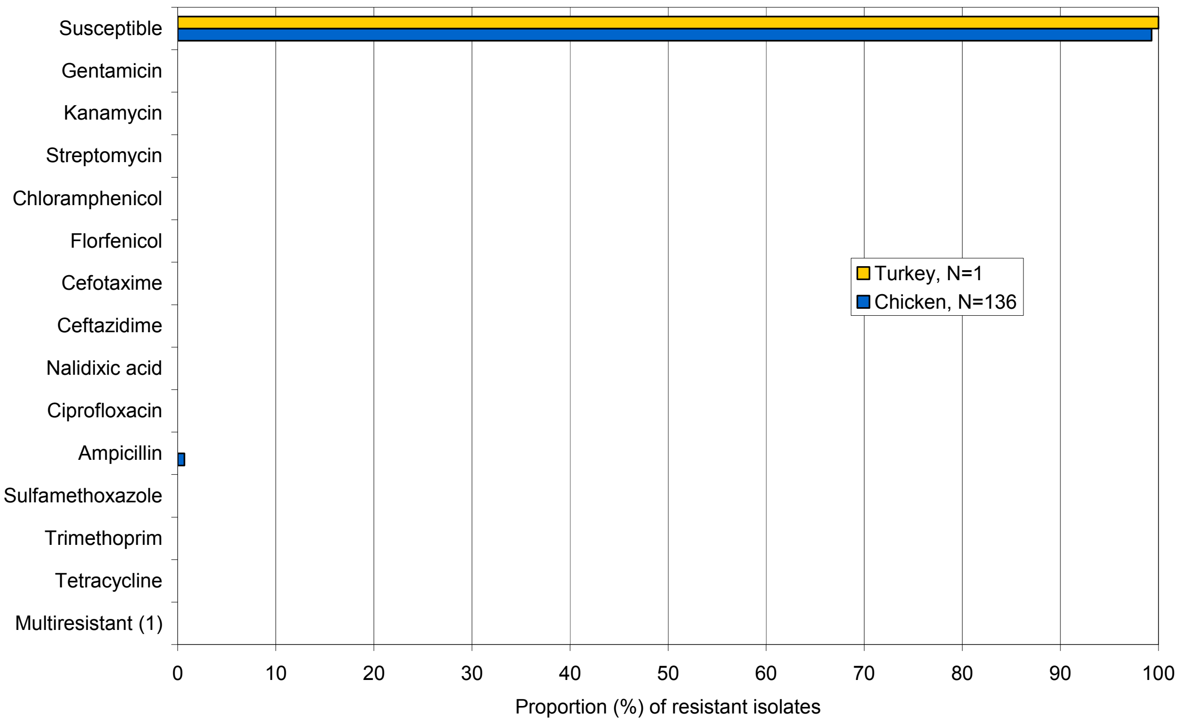
(1) Multiresistant = resistant to more than one class of antimicrobials

5.6.3 S. Enteritidis

Considering *S.* Enteritidis, cattle had the highest proportion of resistant isolates (3/11, 27.3 %, all of them to (fluoro)quinolones, Fig. 5.14), followed by pigs (1/8, 12.5 %, ampicillin, streptomycin, sulfamethoxazole, tetracycline). In chicken resistance was only discovered in one isolate (0.7 %, ampicillin), too. The isolate from turkeys was susceptible.

Fig. 5.14: Comparison of the resistance rates of *S.* Enteritidis from cattle, pig, chicken and turkey to antimicrobial substances (2009)





(1) Multiresistant = resistant to more than one class of antimicrobials

5.6.4 Other serovars

The monophasic serovar *S.* 4,[5],12:i:- occurred above all in cattle and pigs and was less often susceptible with these animal species (3 and 4 % respectively) than *S.* Typhimurium. It usually showed resistance to more than one substance group (97 and 95 % respectively). The highest resistance rates (84–97 %) were seen in the isolates of both species towards ampicillin, streptomycin, sulfamethoxazole and tetracycline, whereby there were only very slight differences between the species. Resistance to third generation cephalosporins (1.5 % and 1.8 % respectively) was also discovered in these isolates and in cattle isolates to ciprofloxacin (7.5 %). Isolates from pigs also showed resistance to gentamicin and kanamycin in several cases and to chloramphenicol (4–6 %), which was not observed in those from cattle.

Isolates of the serovar *S.* 4,[5],12:i:- from chicken mostly showed resistance to the four substances which also had the highest resistance rates in cattle and pigs. Here too, only one of the 12 isolates was susceptible.

Fig. 5.15: Comparison of the resistance rates of *S.* 4,[5],12:i:- from cattle, pig, chicken and turkey to antimicrobial substances (2009)

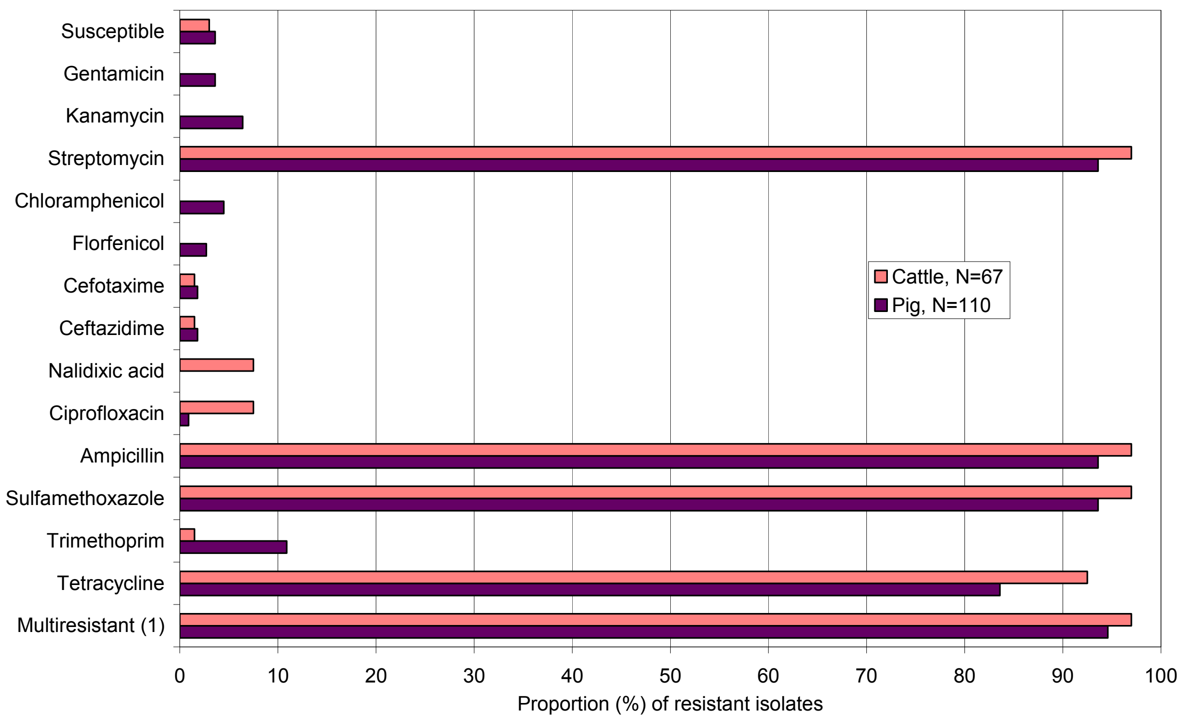
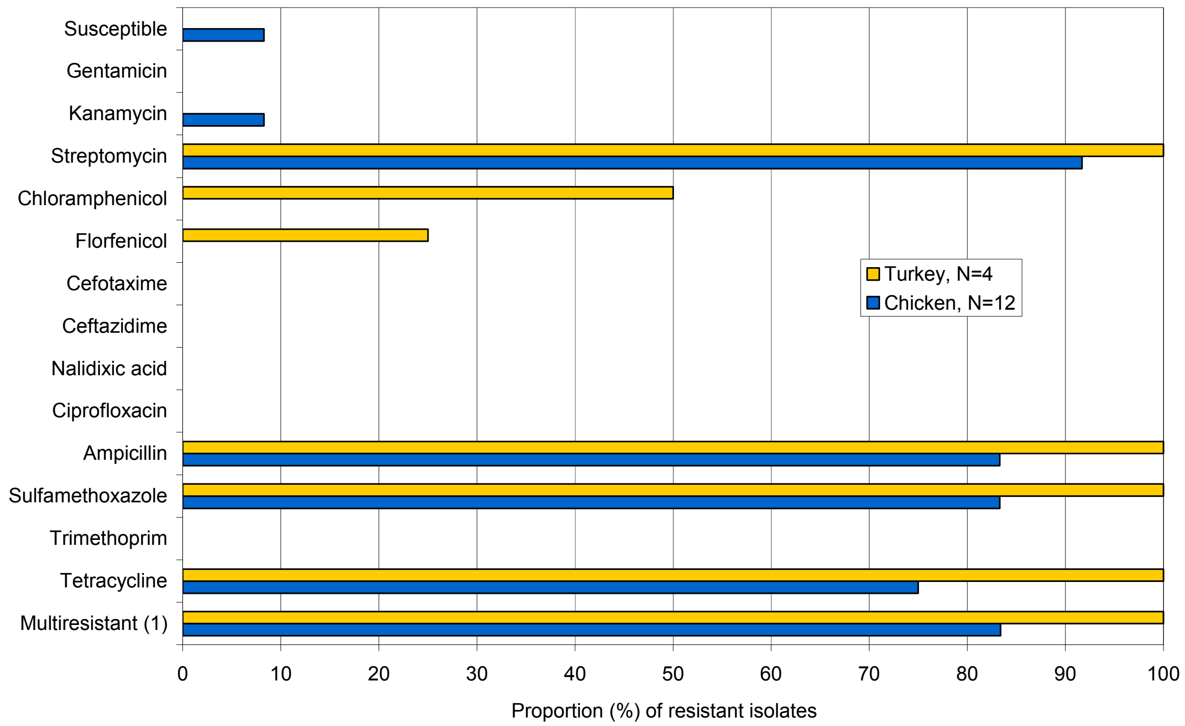


Fig. 5.15: Comparison of the resistance rates of S. 4,[5],12:i:- from cattle, pig, turkey and chicken to antimicrobial substances (2009) (cont.)



(1) Multiresistant = resistant to more than one class of antimicrobials

6 On the resistance situation of *Salmonella* isolates from food

6.1 All food

6.1.1 Serovars

A total of 883 *Salmonella* isolates from food were submitted to the NRL Salm for further investigation in 2009. After *Salmonella* isolates from animals, isolates from food were the second most common ones with proportion of 27.6 %. The percentage of food isolates in all submissions to the NRL Salm in the period 2000–2009 fluctuated between 27.3 % (2004) and 45.1 % (2005).

Overall, 33 different serovars including subspecies were identified in the food isolates. As in 2000–2008 but with a continuing declining trend, the most common serovar was *S.* Typhimurium which, with 185 isolates, only accounted for 21.0 % of all isolates from food. The proportion of the monophasic serovar *S.* 4,[5],12:i:- continued to rise to 17.9 %. In order of their frequency, these are then followed by *S.* Enteritidis (11.9 %), *S.* Derby (5.9 %), *S.* Infantis (4.5 %) and *S.* Paratyphi B dT+ (4.3 %) (Tab. 20.1).

6.1.2 Trend of the serovars

In the period 2000–2005, the proportion of the predominant serovar *S*. Typhimurium in food isolates fluctuated between 29.3 % (2002) and 44.4 % (2001) before dropping to 21.0 % by 2009 (Tab. 20.2). In contrast, detection of the monophasic serovar *S*. 4,[5],12:i:-, which is closely related to *S*. Typhimurium, increased from 0.4 % in 2000 to a proportion of 17.9 % in 2009. The proportion of *S*. Paratyphi B dT+ decreased from 16.3 % (2000) to 1.4 % in 2005, only to increase slightly again to 6.5 % in 2008 and 4.3 % in 2009. Of the top six serovars, the percentages of *S*. Enteritidis, *S*. Derby and *S*. Infantis remained relatively constant within a limited range (Tab. 20.2).

6.1.3 Serovar resistance

Overall, 57.8 % of the 883 isolates were resistant, whereby 49.1 % showed multiple resistance and 8.7 % were only resistant to one class of the tested antimicrobial substances (Tab. 20.7). A high number of isolates was resistant to the substances ampicillin (44.2 %), sulfamethoxazole (43.6 %), tetracycline (43.1 %) and streptomycin (36.8 %). The isolates showed resistance rates to trimethoprim of 15.4 %, chloramphenicol 10.1 % and florfenicol 7.1 %. A similar resistance level resulted for ciprofloxacin with 12.6 % and a slightly lower one for the quinolone nalidixic acid with 11.2 %. The aminoglycosides kanamycin (4.5 %) and gentamicin (1.8 %) showed low resistance rates. The resistance rate to the tested cephalosporins cefotaxime and ceftazidime was comparable to that of 2008 (1.2 to 1.1 %).

The most frequently detected serovar *S.* Typhimurium (185 isolates, 21.0 %) was 77.8 % resistant, whereby the percentage of multiresistant isolates (73.5 %) was well above the single resistance rate (4.3 %). The following rates of resistance to the individual substances were established: ampicillin 73.5 %, sulfamethoxazole 72.4 %, tetracycline 70.3 %, streptomycin 60.5 %, chloramphenicol 36.2 %, florfenicol 31.9 % and trimethoprim 22.7 %. The values for the other substances were between 6.5 % for ciprofloxacin/nalidixic acid and 0.0 % for the tested cephalosporins.

The monophasic serovar *S.* 4,[5],12:i:-, which is genotypically closely related to *S.* Typhimurium, also showed an increasing number of isolates and had a proportion of 17.9% in food with 158 isolates. A quadruple resistance to sulfamethoxazole (89.9 %), streptomycin and ampicillin (89.2 % each) and tetracycline (84.8 %) was clearly dominant here. In contrast, the isolates did not show any resistance to the tested (fluoro)quinolones, cephalosporins, gentamicin and florfenicol.

Among the 105 isolates of *S.* Enteritidis, the second most common serovar (11.9 % of all food isolates), only 18.1 % isolates with single and multiple resistance were detected. The highest rate of resistance of 9.5 % was observed towards ciprofloxacin. Other resistances only occurred towards nalidixic acid and ampicillin with 8.6 %, respectively.

The third most common serovar was *S.* Derby with 52 isolates (5.9 % of all food isolates). Of these, 34.6 % were resistant (25.0 % to one substance class and 9.6 % to two to four classes). The most frequent resistances were towards sulfamethoxazole and trimethoprim, each with 17.3 %, followed by tetracycline with 15.4 % and then ampicillin and streptomycin with 7.7 % each. There was no resistance to the other tested aminoglycosides, quinolones and third generation cephalosporins.

Of the 38 *S.* Paratyphi B dT+-isolates (4.3 % of all food isolates), 97.4 % were resistant, 7.9 % to one substance class and 89.5 % to two to six substance classes. The highest resistance rates were determined towards trimethoprim with 97.4 % and ciprofloxacin/nalidixic acid with 81.6 %/79.0 %. This was followed by sulfamethoxazole and ampicillin with 44.7 % and 39.5 %, respectively. Resistance to third generation cephalosporins (ceftazidime and cefotaxime), each with 18.4 %, was noteworthy.

6.1.4 Trend of resistance

The resistance rate of *Salmonella* isolates from food rose in 2009 to 57.8 %, which means that the continuous increase since 2006 (46.1 %) carried on. This also applies to multiresistant isolates, where the percentage increased from 29.4 % in 2003 to no less than 49.0 % in 2009. The picture is more varied with the individual substances. An increase in resistant isolates was observed above all towards tetracycline (to 49.0 %), ampicillin (to 44.2 %), streptomycin (to 36.8 %) and sulfamethoxazole (to 43.6 %). This was attributable mainly to the increase in the monophasic *S*. Typhimurium with quadruple resistance (*S*. 4,[5],12:i:-) and *S*. Typhimurium. There were also slight increases over 2008 (0.2–0.9 %) for trimethoprim, chloramphenicol and the cephalosporins cefotaxime and ceftazidime. A decrease (0.8–4.9 %) in the resistance rates was registered towards gentamicin, kanamycin and florfenicol, as well as ciprofloxacin and nalidixic acid.

6.2 Meat in total

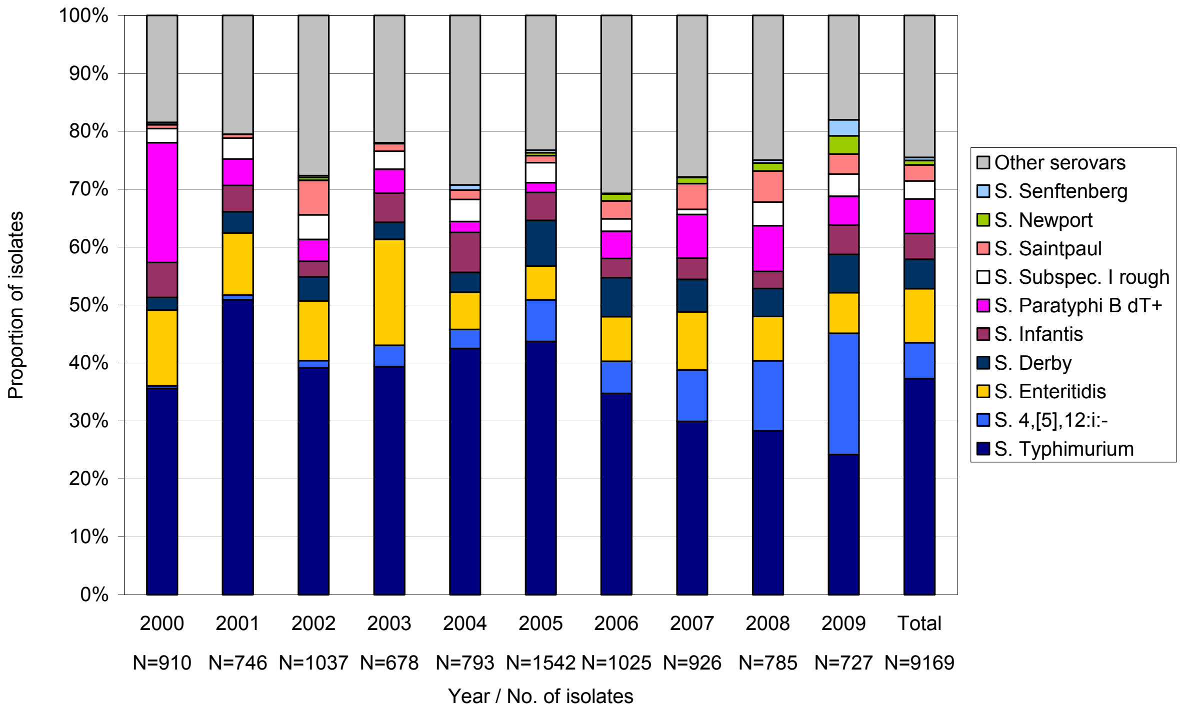
6.2.1 Serovars

Among the food isolates, the category meat made up the majority of origins with 727 isolates (82.3 %), whereby the annual proportion in the investigation period 2000–2009 fluctuated between 85.3 % and 66.0 %. The proportion of the predominant serovar *S.* Typhimurium decreased further in 2009 and now amounts to only 24.2 %. In contrast, the monophasic variant of *S*. Typhimurium (*S.* 4,[5],12:i:-) has increased sharply and now has a proportion of 20.9 %, followed by *S.* Enteritidis (7.0 %), *S*. Derby (6.6 %), *S.* Infantis (5.1 %) and *S.* Paratyphi B dT+ (5.0 %) (Fig. 6.1 and Tab. 20.116).

6.2.2 Trend of the serovars

The proportion of the predominant serovar *S.* Typhimurium in meat isolates fluctuated during the investigation period between 50.9 % in 2001 and 24.2 % in 2009. Since 2005, the proportion of *S.* Typhimurium has decreased continuously from 43.7 % to 24.2 %. In contrast, the proportion of the monophasic variant *S.* 4,[5],12:i:- of *S.* Typhimurium has risen from 0.4 % (2000) to 20.9 % in 2009. The proportion of *S.* Enteritidis has dropped since 2003 from 18.3 % to 7.0 % in 2009. With *S.* Paratyphi B dT+, the proportion increased again since 2005 (1.7 %) to 7.9 % in 2008, but dropped back to 5.0 % in 2009. The percentage of *S.* Infantis fell from 6.0 % in 2000 to 2.9 % in 2008 and climbed back to 5.1 % in 2009 (Fig. 6.1 and Tab. 20.117).

Fig. 6.1: Proportion of the ten most frequent *Salmonella* serovars among the isolates from meat (2000–2009)



6.2.3 Serovar resistance

The resistance situation in isolates from meat was determined mainly by the serovars *S.* Typhimurium, its monophasic variant *S.* 4,[5],12:i:- and *S.* Paratyphi B dT+, the resistance rates of which ranged from 79.0 to 97.2 %. Overall, 66.7 % of all isolates from meat were resistant, whereby the proportion with multiple resistance increased again and now is at 57.5 % (all foods 49.0 %). If the resistance rates of the isolates from both origins are compared with each other, it was almost 10 % higher in meat (66.7 %) than in all foods together (57.8 %). Most of the individual substances showed the same tendency. The highest rates of resistance of meat isolates were towards tetracycline (50.9 %), sulfamethoxazole (50.8 %), ampicillin (50.6 %) and streptomycin (43.1 %). With the cephalosporins ceftazidime and cefotaxime, the proportion (1.2 %) was the same as it was in food, whereas the resistance rates with the (fluoro)quinolones ciprofloxacin and nalidixic acid (14.9 %/13.2 %) were slightly higher than those of all foods (12.6 %/11.2 %) (Fig. 6.2 and Tab. 20.122).

In *S.* Typhimurium, the predominant serovar in meat with 24.2 % (176 isolates), 79.0 % of the isolates (139) were resistant and 74.4 % (131 isolates) showed multiple resistances. The proportion of resistant isolates fluctuated during the investigation period (2000–2009) between 85.2 % (2000) and 69.9 % (2006), but were between 70 and 80 % in most years. The *Salmonella* isolates showed high rates of resistance to more than half of the individual substances tested (74.4 to 23.3 %) so that the *S.* Typhimurium isolates were decisive in determining the resistance situation in meat and therefore food in general in terms of both numbers as well as the percentage of resistant isolates. The *S.* Typhimurium isolates from meat frequently showed a quadruple resistance to ampicillin (74.4 %), sulfamethoxazole (73.3 %), tetracycline (71.0 %) and streptomycin (60.8 %). Resistance to chloramphenicol (35.8 %), florfenicol (31.3 %) and trimethoprim (23.3 %) occurred to a lesser extent. The resistance rates with the quinolones (2000–2007) fluctuated between 2.5 % and 6.5 %, but they increased to 9.5 % (ciprofloxacin) and 8.6 % (nalidixic acid) in 2008 and levelled out at 6.8 % respectively in 2009. No *S.* Typhimurium isolates resistant to the tested cephalosporins were observed. The percentages of isolates resistant to the tested aminoglycosides kanamycin and gentamicin (5.7 %/0.6 %) was comparable with those of all foods (5.4 %/0.5 %).

The number of monophasic *S.* Typhimurium isolates *S.* 4,[5],12:i:- from meat (152; 20.9 %) increased in 2009 too (Tab. 20.126). A quadruple resistance to sulfamethoxazole (90.1 %), streptomycin and Ampicillin (89.5 % each) and tetracycline (85.5 %) was even more dominant here than in *S.* Typhimurium. The only other resistances observed were towards kanamycin (4.6 %) and trimethoprim (3.9 %).

S. Enteritidis, the third most common serovar detected in meat with 7.0 % (51 isolates), was mainly (74.5 %) susceptible to the tested substance classes (Tab. 20.124, Fig. 6.2). The 13 resistant isolates all only showed single resistance. The percentage of resistant isolates dropped steadily in the investigation period from 52.1 % in 2000 to 6.7 % in 2008, but it increased again in 2009 to 25.5 % due mainly to the rise in isolates with resistance to (fluoro)quinolones (ciprofloxacin, 19.6 % and nalidixic acid 17.6 %). Apart from resistance to ampicillin (5.9 %), there was no further resistance in *S.* Enteritidis.

The fourth most common serovar in meat in 2009 was *S.* Derby (48 isolates; 6.6 %), which indicates a high percentage of pork meat in the meat category. Of the 48 isolates, 33.3 % were resistant, whereby in addition to single resistance (22.9 %) double and treble resistance (4.2 % each) as well as quadruple resistance (2.1 %) occurred. The predominant single resistance was towards tetracycline (16.7 %) as well as sulfamethoxazole and trimethoprim with 14.6 % each. No resistances to the tested (fluoro)quinolones and cephalosporins occurred in this serovar.

With 37 and 36 isolates (5.1 and 5.0 %) respectively, *S.* Infantis and *S.* Paratyphi B dT+ were the fifth and sixth most common serovars in meat. There were big differences in the resistance rates of these two serovars with 59.5 and 97.2 % respectively. This also applied to the number of multiresistant isolates the proportions of which were 48.6 and 88.9 % (Fig. 6.4).

S. Infantis isolates were frequently resistant to sulfamethoxazole (45.9 %), tetracycline (37.8 %), nalidixic acid and ciprofloxacin (35.1 % each). This serovar was also one of the few from meat which was resistant to the cephalosporins cefotaxime and ceftazidime (5.4 % each).

The *S.* Paratyphi B dT+ isolates were distinguished by a high resistance to trimethoprim (97.2 %), ciprofloxacin (80.6 %) and nalidixic acid (77.8 %). Resistance to the two cephalsporins was almost three times higher (13.9 %) as in the *S.* Infantis isolates. The isolates were only susceptible to florfenicol; otherwise the resistance rate with all other antimicrobial substances lay between 8.3 % (gentamicin) and 44.4 % (sulfamethoxazole).

Fig. 6.2: Resistance of selected *Salmonella* serovars from meat to antimicrobial substances (2009); Number of classes of antimicrobials the isolates were resistant to

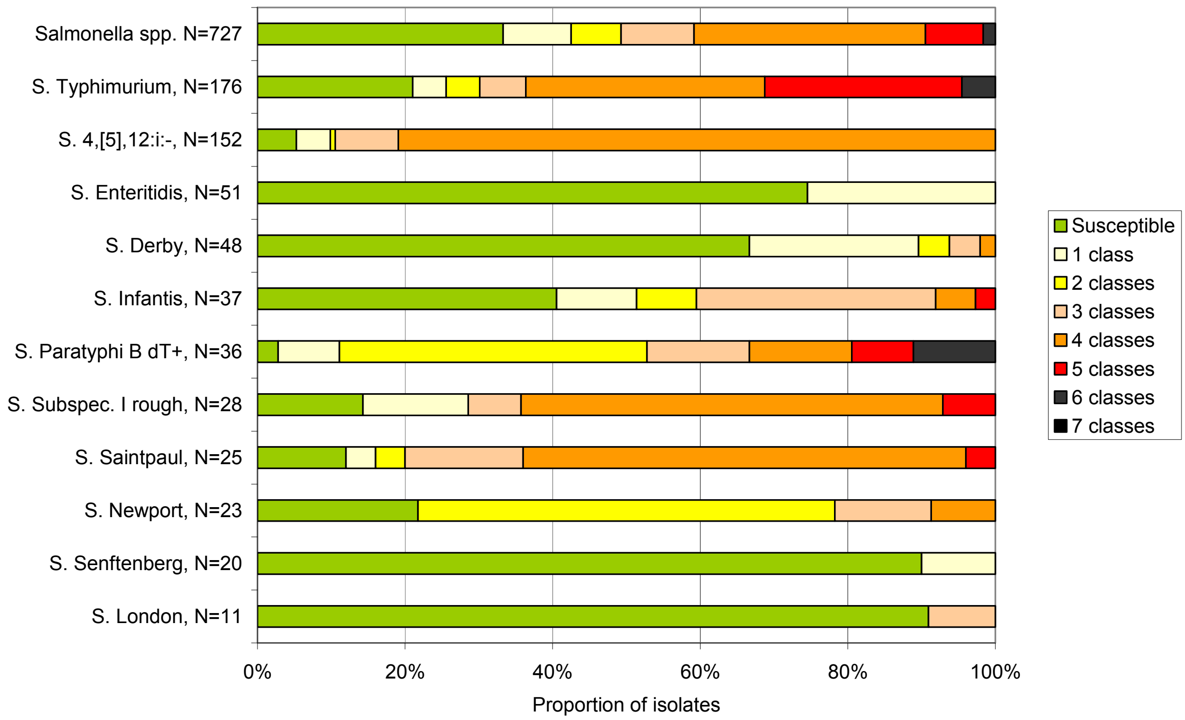
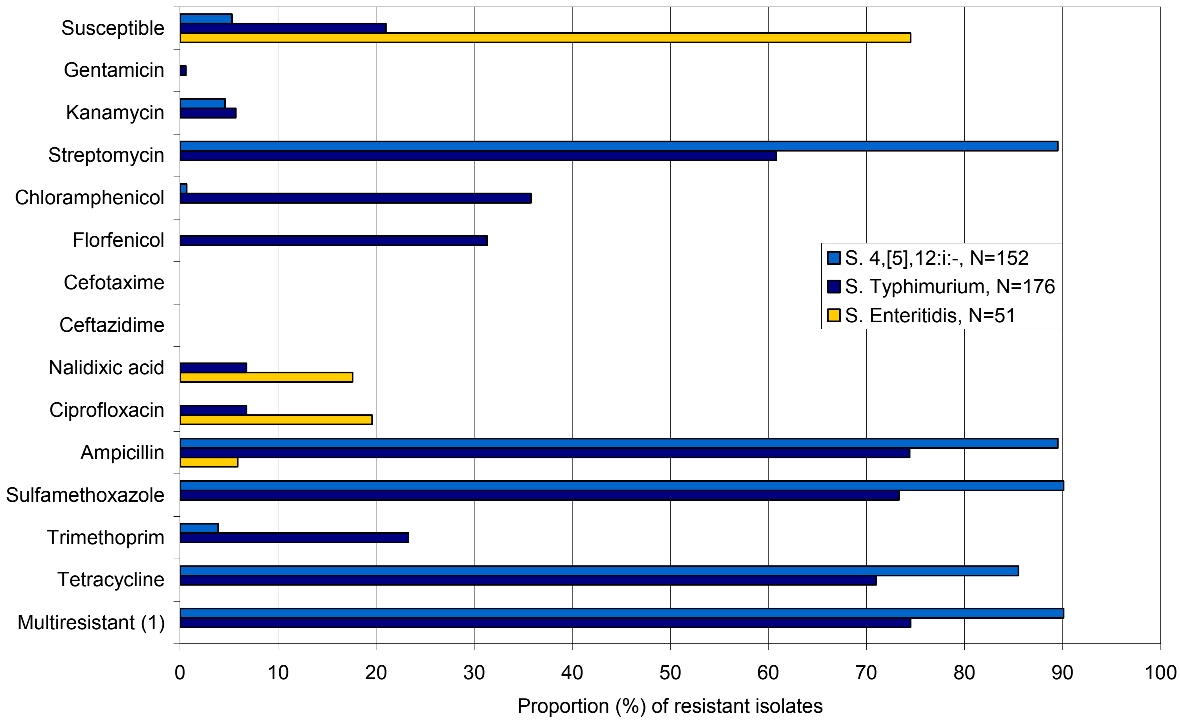


Fig. 6.3: Resistance of selected *Salmonella* serovars from meat to antimicrobial substances (2009)



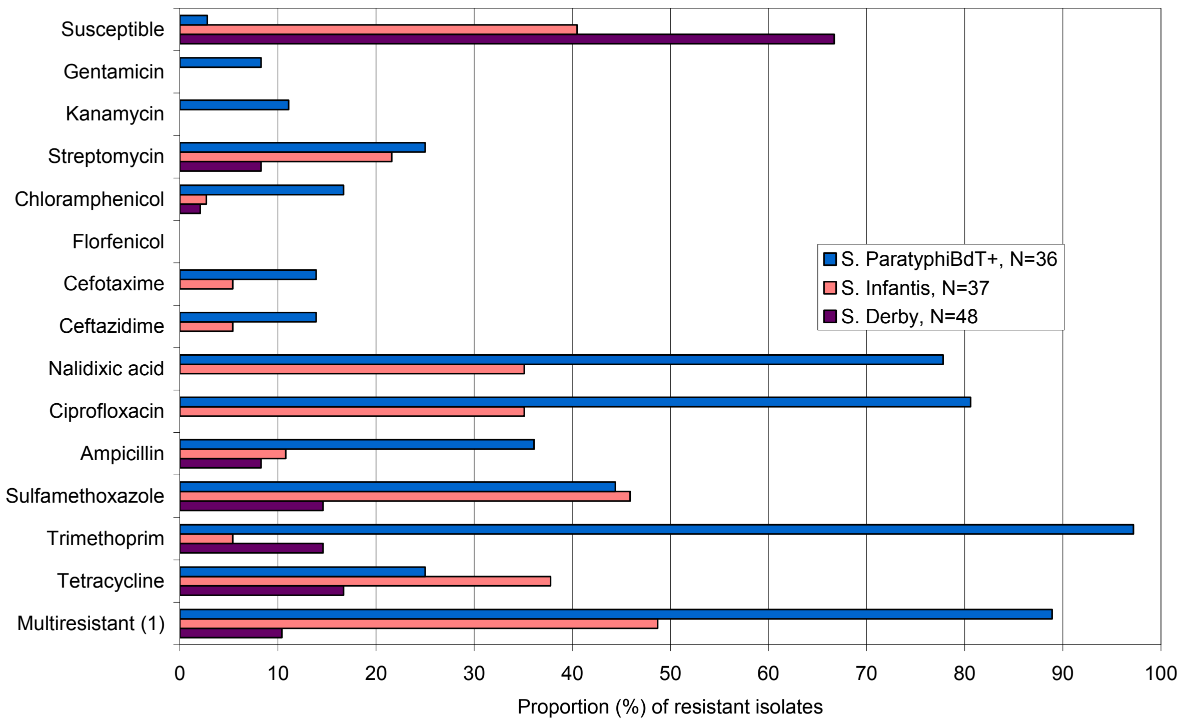
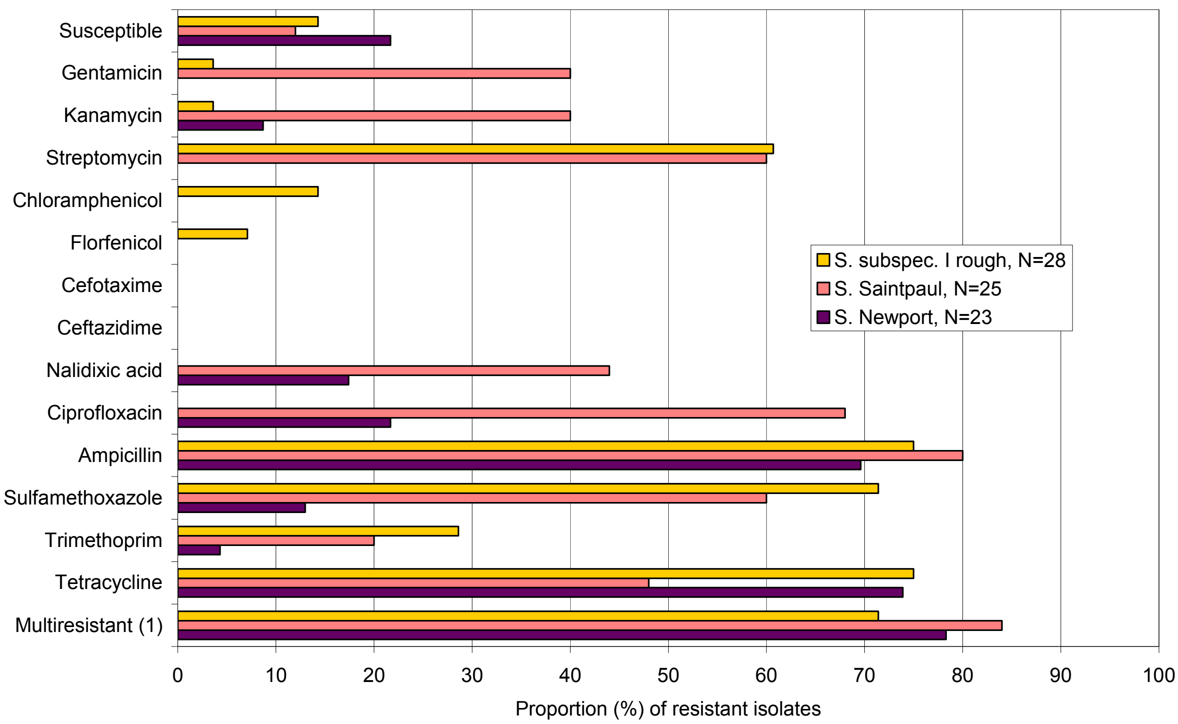


Fig. 6.4: Resistance of selected *Salmonella* serovars from meat to antimicrobial substances (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

6.2.4 Trend of resistance

The proportion of resistant isolates in meat continued to rise in 2009 and was at 66.7 %. This was caused above all by an increase in resistance to tetracycline, sulfamethoxazole, ampicillin and streptomycin, to which the monophasic *S*. Typhimurium and *S*. Typhimurium isolates contributed in particular to rising resistance rates. For all other substances, the resistance rate changed only slightly over 2008 either upwards or downwards and was between 1.2 % for cefotaxime/ceftazidime and 17.6 % for trimethoprim.

6.3 Chicken meat

6.3.1 Serovars

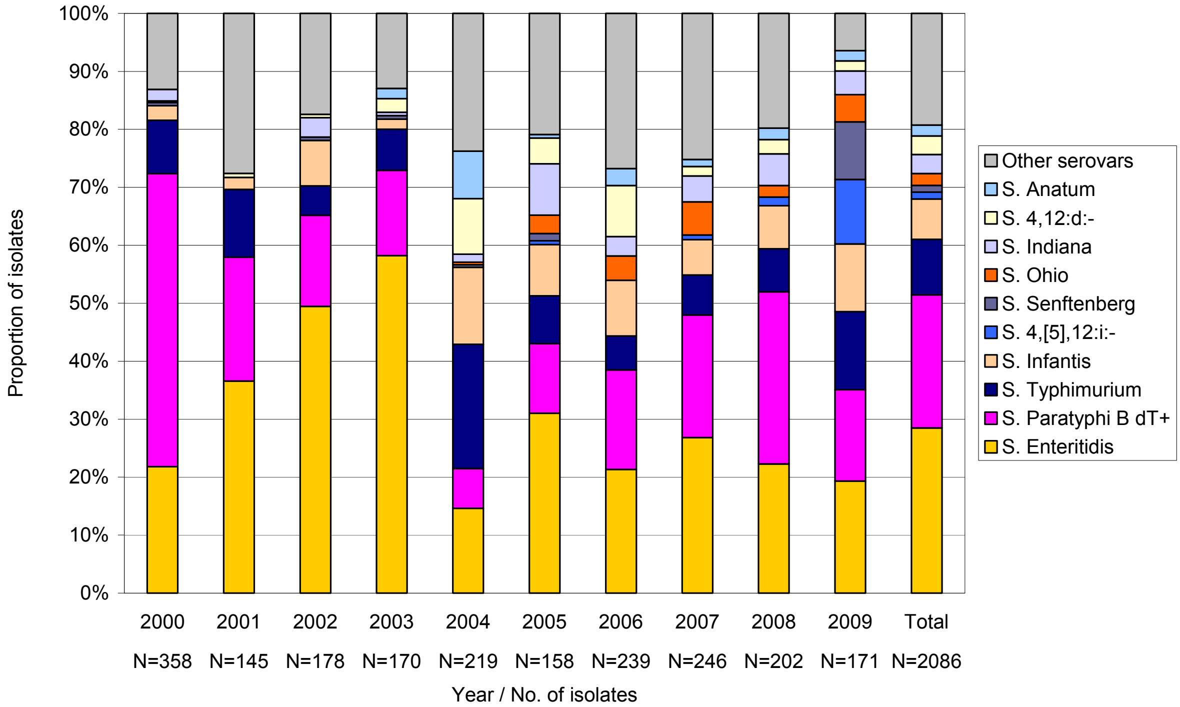
Of the total of 9,169 isolates (2000–2009) of meat, 2,086 (22.8 %) were from chicken meat, whereby the annual proportion fluctuated between 358 (18.7 %) and 145 (7.6 %) isolates. A total of 48 different serovars were identified in chicken meat.

171 Salmonella isolates from chicken meat were investigated in 2009. The predominant serovar was *S.* Enteritidis, but with a proportion of only 33 isolates (19.3 %) of this origin, followed by *S.* Paratyphi B dT+ with 28 isolates (16.4 %), *S.* Typhimurium with 23 isolates (13.5 %), *S.* Infantis with 20 isolates (11.7 %) and *S.* 4,[5],12:i:- with 19 isolates (11.1 %) (Fig. 6.5).

6.3.2 Trend of the serovars

The proportion of *S*. Enteritidis decreased from 29.3 % (2000–2008) to 19.3 % in 2009. The same applied to a lesser extent to *S*. Paratyphi B dT+ which fell from 23.6 % to 16.4 %. In contrast, the proportion of *S*. Typhimurium increased more strongly to 13.5 %, *S.* Infantis to 11.7 % and above all the monophasic variant of *S*. Typhimurium (*S*. 4,[5],12:i:-) to 11.1 % in 2009 (Fig. 6.3).

Fig. 6.5: Proportion of the ten most frequent *Salmonella* serovars among the isolates from chicken meat (2000–2009)



6.3.3 Serovar resistance

Of the 171 isolates of chicken meat, 92 (53.8 %) were resistant and 77 (45.0 %) multiresistant (Fig. 6.6). Overall, there was a further increase in the proportion of resistant and multiresistant isolated in chicken meat in 2009 (Tab. 20.136).

The resistance rate towards the individual substances was highest with sulfamethoxazole (35.7 %). This was followed by ciprofloxacin and tetracycline, each with 29.8 % and nalidixic acid and ampicillin, each with 28.7 %. The resistance rates with the other antimicrobial substances tested were between 3.5 % for the investigated third generation cephalosporins (cefotaxime/ceftazidime) and 24.0 % for streptomycin.

Once again in 2009, the serovar *S.* Enteritidis was less resistant in isolates from chicken meat (21.2 %) than most of the other identified serovars. None of the isolates showed multiple resistances (Tab. 20.136). Compared to past years, however (since 2002), the proportion of resistant isolates dropped to 21.2 % for the first time due solely to resistance to ciprofloxacin/nalidixic acid (21.2 % each). The *S*. Enteritidis isolates were susceptible to all 12 of the other antimicrobial substances tested.

The incidence and resistance of the serovar *S.* Paratyphi B dT+ had a crucial impact on the resistance situation in *Salmonella* isolates from chicken meat, because in 2009 100 % of the

27 isolates were resistant and 92.6 % multiresistant (Tab. 20.136). Resistance to trimethoprim (100 %) also occurred extremely frequently, followed by ciprofloxacin (85.2 %) and nalidixic acid (81.5 %). The rate of resistance to the other antimicrobial substances was between 44.4 % for sulfamethoxazole and 11.1 % for gentamicin. All isolates were susceptible to florfenicol. Resistance to the tested cephalosporins also increased from 11.7 % in 2008 to 14.8 % in 2009.

S. Typhimurium also made a more significant contribution to the resistance situation of *Salmonella* isolates in chicken meat in 2009 than it did in 2008. Of the 23 isolates of this serovar, 52.2 % were resistant and 43.5 % multiresistant (Tab.20.136). Compared to 2008, the proportion of resistant isolates rose from 20.0 % to 52.2 %. Isolates with penta- and hexaresistance were remarkable with 17.4 % each. The highest individual resistance was to tetracycline with 47.8 %, sulfamethoxazole and streptomycin each with 43.5 %, ampicillin with 39.1 % and chloramphenocol/florfenicol each with 34.8 %. Five isolates (21.7 %) were resistant to ciprofloxacin and five to nalidixic acid, whereas none of the 23 isolates showed a resistance to the tested cephalosporins.

The fourth most common serovar detected in chicken meat was *S.* Infantis with 20 isolates (Tab. 20.136). Of these, 80.0 % were resistant and 75.0 % multiresistant, which complies exactly with the values for 2008 (15 isolates). The highest proportion of isolates was resistant to sulfamethoxazole with 70.0 %, tetracycline with 60.0 %, nalidixic acid and ciprofloxacin each with 55.0 %. Two isolates (10.0 %) were resistant to cefotaxime and ceftazidime.

All 19 isolates (100 %) of the monophasic *S*. Typhimurium (*S.* 4,[5],12:i:-) were multiresistant (triple 26.3 %, quadruple 73.7 %). There was 100 % resistance to ampicillin, streptomycin and sulfamethoxazole, as opposed to 73.7 % to tetracycline and 5.3 % to kanamycin. The isolates were susceptible to all other antimicrobial substances tested (Tab. 20.136).

Fig. 6.6: Resistance of selected *Salmonella* serovars from chicken and turkey meat to antimicrobial substances (2009); Number of classes of antimicrobials the isolates were resistant to

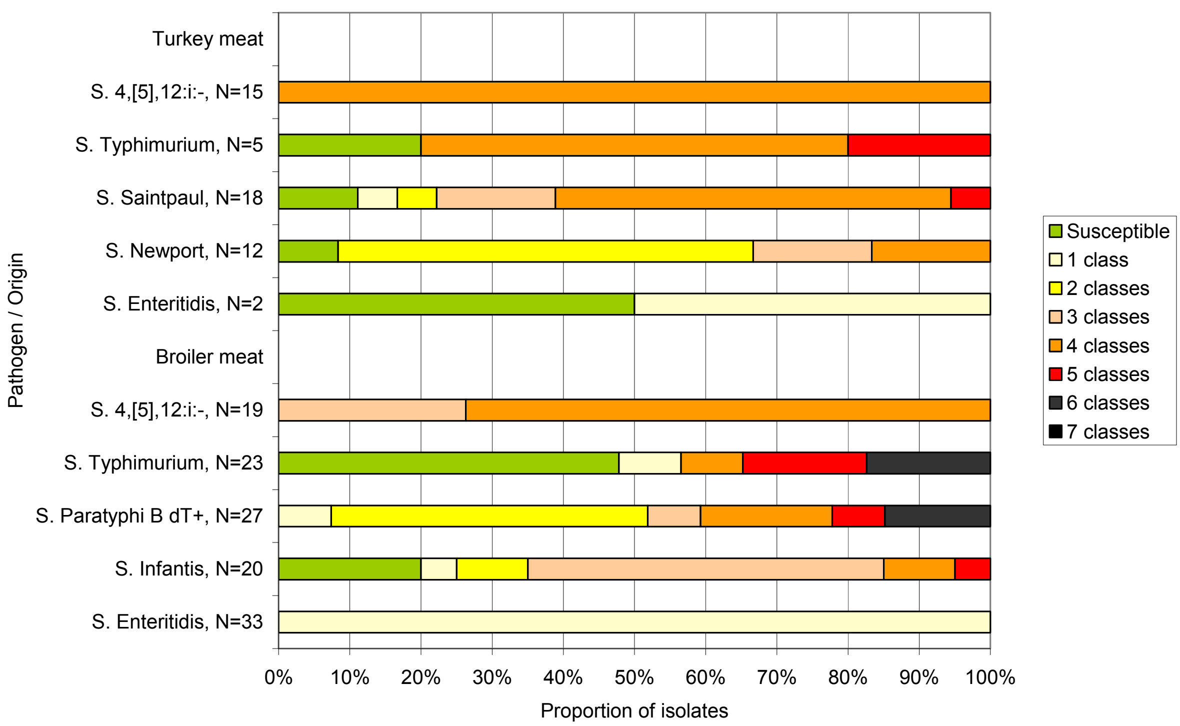
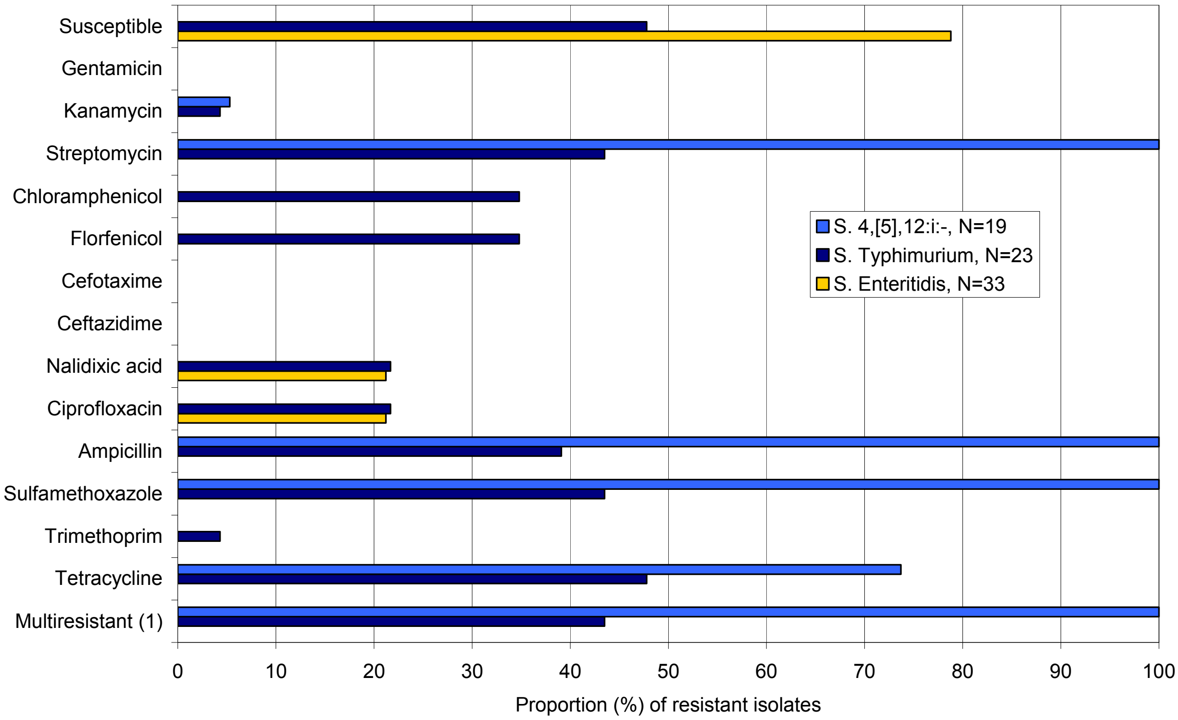
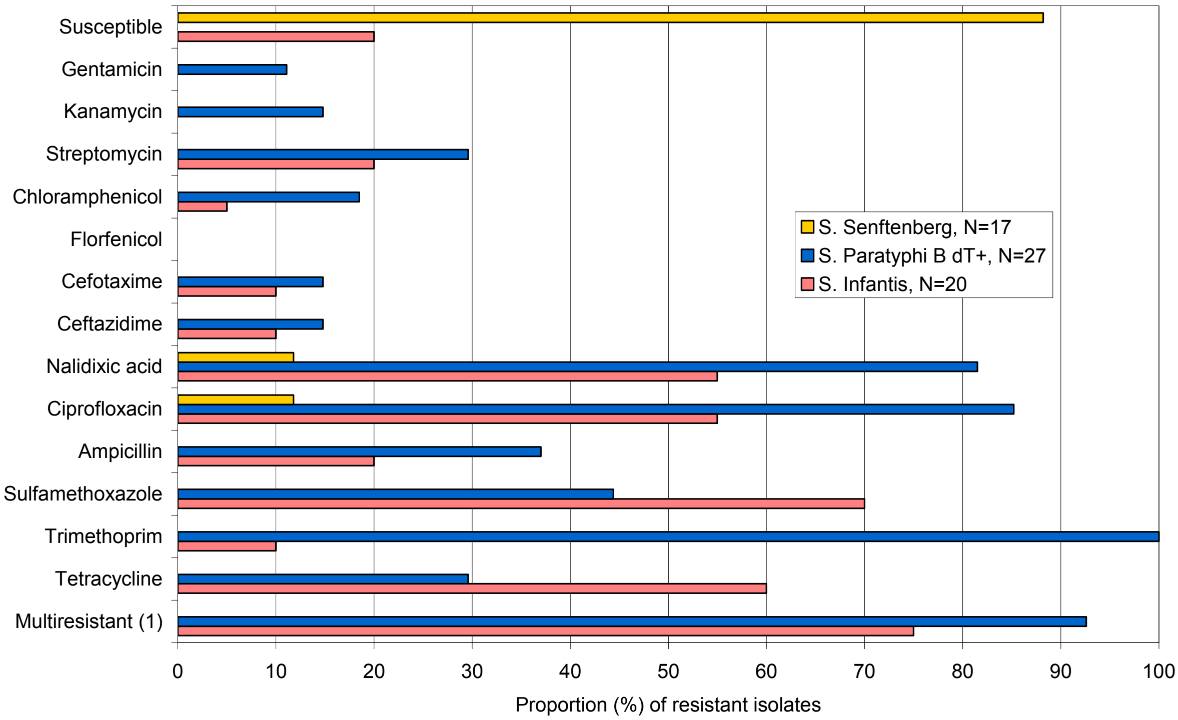


Fig. 6.7: Resistance of selected *Salmonella* serovars from chicken meat to antimicrobial substances (2009)





(1) Multiresistant = resistant to more than one class of antimicrobials

6.3.4 Trend of resistance

The resistance situation in chicken meat is marked by the prevalence of certain serovars (*S*. Paratyphi B dT+, *S*. Typhimurium, *S*. Infantis, *S*. 4,[5],12:i:-) and their resistance profile. Overall, the proportion of resistant and multiresistant isolates increased again in 2009 (53.8 and 45.0 %, respectively). A resistance rate that almost doubled was observed towards streptomycin (from 12.9 % in 2008 to 24.0 % in 2009). Increases in resistance of between 6 and 9 % were also recorded for sulfamethoxazole (to 35.7 %), ampicilin (to 28.7 %) and tetracycline (to 29.8 %). There was a slight reduction for ciprofloxacin/nalidixic acid to their present level of 29.8 and 28.7 % respectively. The increase in resistance to chloramphenicol/florfenicol from 1.5/0.5 % in 2008 to 8.8 and 4.7 % in 2009 should be kept under observation. The decrease in resistance to the cephalosporins in 2009 to 3.5 % from 4 % in 2008 is negligible.

6.4 Turkey meat

6.4.1 Serovars

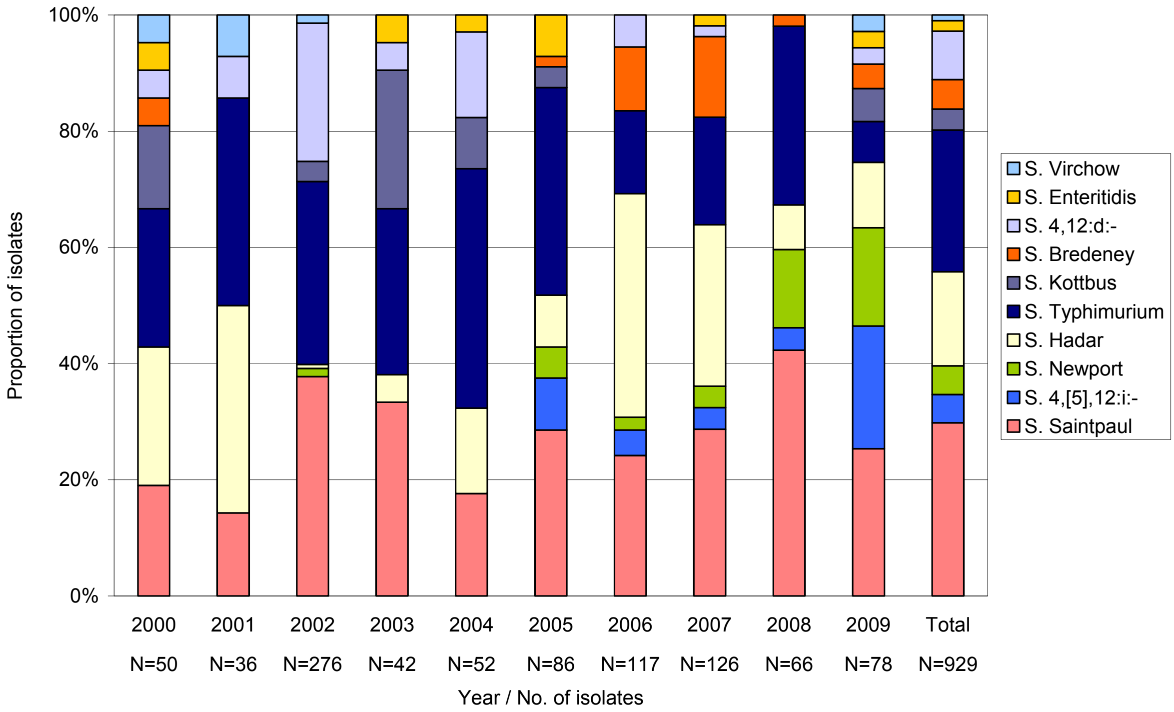
The number of investigated isolates from turkey meat increased to 929 in the period 2000–2009, thus making up 10.1 % of all isolates originating from meat (9,169). The annual number of turkey meat isolates fluctuated severely between 36 (3.9 %) and 276 (29.7 %) of all turkey isolates. A total of 31 different serovars were identified (Tab. 20.120).

The predominant serovars in 2009 were again *S.* Saintpaul with 18 isolates (23.1 %), followed by monophasic *S.* Typhimurium (4,[5],12:i:-) with 15 (19.2 %), *S*. Newport with 12 (15.4 %), *S.* Hadar with 8 (10.3 %) and *S*. Typhimurium with 5 (6.4 %).

6.4.2 Trend of the serovars

The proportion of *S.* Saintpaul isolates was reduced by almost 10 % to 23.1 %, and the same applies to *S*. Typhimurium (6.4 %). In contrast, the proportion of monophasic *S*. Typhimurium rose sharply to its current level of 19.2 %, an increase which also applies to a lesser degree to *S*. Newport (15.4 %). The proportion of the other serovars, such as *S.* Hadar, *S.* Heidelberg and *S.* Indiana, was subject to strong fluctuations over the years (Fig. 20.120).

Fig. 6.8: Proportions of the ten most frequent *Salmonella* serovars among the isolates from turkey meat (2000-2009)



6.4.3 Serovar resistance

Of the 78 isolates in 2009, 85.9 % were resistant and 75.6 % multiresistant (Tab. 20.142). Overall, there was a 3.5 % reduction over 2008 in the percentage of resistant and multiresistant isolates. A high resistance rate was determined towards the substances tetracycline (66.7 %), ampicillin (61.5 %), sulfamethoxazole (50.0 %) and streptomycin (47.4 %). This was followed by ciprofloxacin (37.2 %), nalidixic acid (29.5 %) and kanamycin (19.2 %). Resistance to ceftazidime and cefotaxime, each with 2.6 %, was identified in turkey meat isolates for the first time (Fig. 6.8 and Tab. 20.142). Resistance to the other antimicrobial substances ranged between 15.4 % (trimethoprim) and 2.6 % (chloramphenicol/florfenicol).

S. Saintpaul, which was predominant with 18 isolates (23.1 %), was resistant to 88.9 % and multiresistant to 83.3 %. The percentage of resistant and multiresistant isolates has dropped by 11.1 and 7.6 % respectively over 2008 (Tab. 20.144). The following antimicrobial substances showed resistance rates of 50 % and more: ampicillin (77.8 %), ciprofloxacin (66.7 %), sulfamethoxazole (61.1 %), streptomycin (55.6 %) and tetracycline (50.0 %). The high resistance rate of the isolates towards the aminoglycosides gentamicin and kanamycin, each with 38.9 %, was remarkable. There was no resistance to chloramphenicol/florfenicol and the cephalosporins ceftazidime/cefotaxime.

The second most common serovar detected in turkey meat in 2009 was the monophasic *S.* Typhimurium (4,[5],12:i:-) with 19.2 %. All 15 isolates (100 %) showed quadruple resistance to ampicillin, streptomycin, sulfamethoxazole and tetracycline (Tab. 20.142). Kanamycin resistance was only detected in three isolates (20.0 %). The isolates were susceptible to all other antimicrobial substances tested.

With 12 isolates (15.4 %), *S.* Newport was the third most common serovar in turkey meat in 2009. The number of isolates per year ranged from zero (2000, 2001, 2003, 2004) to 12 (2009) (Tab. 20.120). 91.7 % of the isolates were multiresistant in 2009. No isolates with single resistance were detected. The isolates were resistant to the following single substances: tetracycline (91.7 %), ampicillin (75.0 %), ciprofloxacin, nalidixic acid and sulfamethoxazole (25.0 % each), kanamycin (16.7 %) and trimethoprim (8.3 %). The isolates were susceptible to all other antimicrobial substances tested.

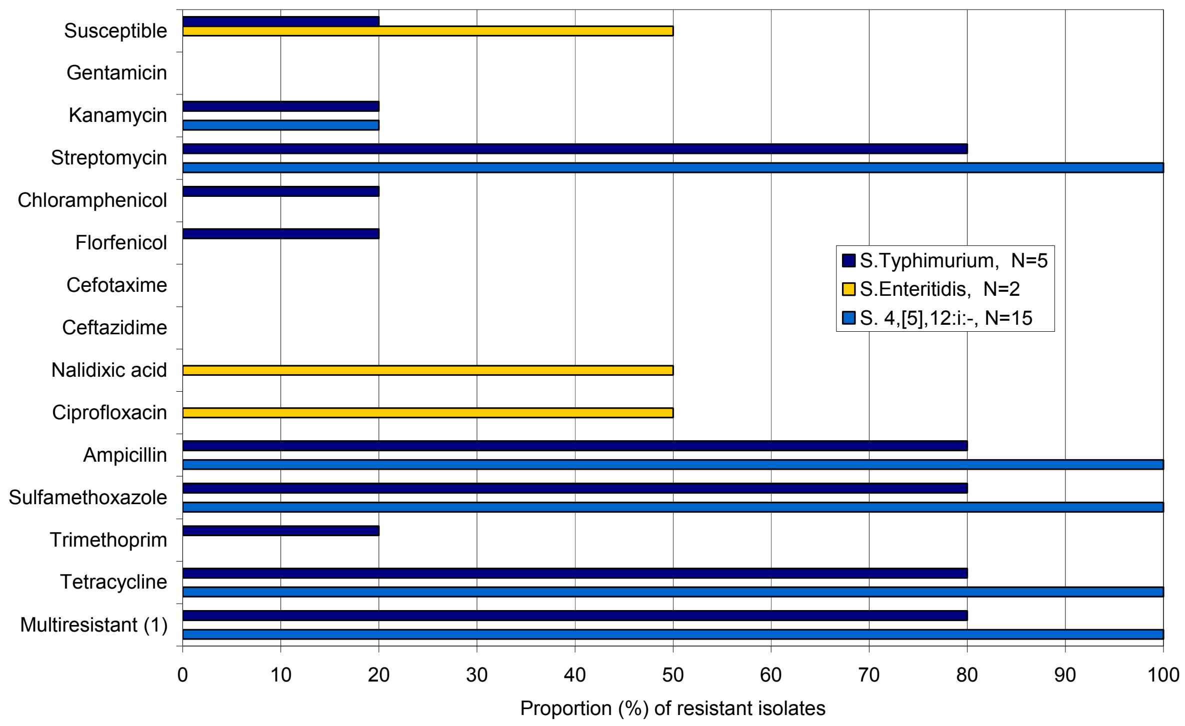
All of the isolates of *S.* Hadar, the fourth most common serovar (10.3 %, 8 isolates), were resistant and 87.5 % multiresistant. The number of isolates per year varied between one and eight and only in 2006 (35) and 2007 (30) more isolates were submitted (Tab. 20.120). The isolates were resistant particularly often in 2009 to streptomycin (62.5, %), ciprofloxacin (50.0 %), nalidixic acid (37.5 %), sulfamethoxazole and trimethoprim (25.0 % each), as well as chloramphenicol, florfenicol and ampicillin with 12.5 % respectively. No resistance to third generation cephalosporins, kanamycin and gentamicin was detected in the isolates.

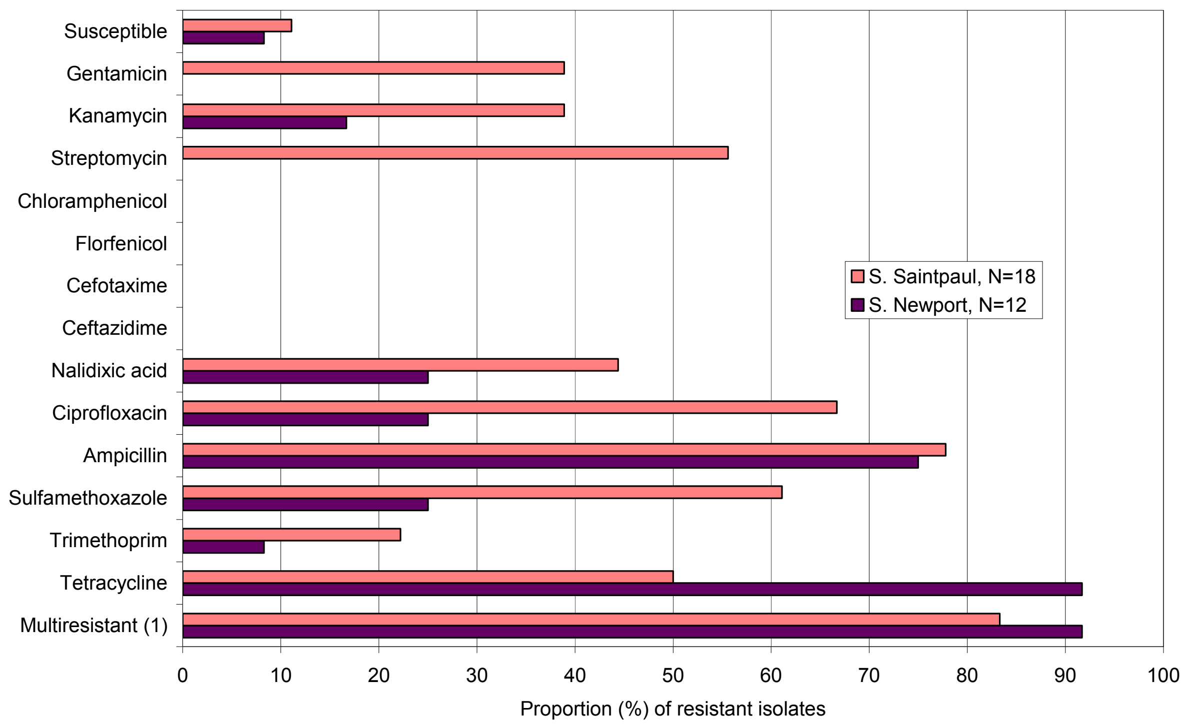
Of the five *S.* Typhimurium isolates (6.4 %) submitted from turkey meat, four (80 %) were multiresistant (Tab. 20.143). The resistance rate was 80 % for each of the substances sulfamethoxazole, streptomycin, tetracycline and ampicillin and 20 % for kanamycin, chloramphenicol, florfenicol and trimethoprim. The isolates were susceptible to all other tested substances.

6.4.4 Trend of resistance

Due to variation in the number of submissions of turkey meat isolates per year (between 36 in 2001 and 276 in 2002), as well as the serovars that occurred in each of them along with their percentages and resistance profiles, the percentage of resistant isolates from turkey meat fluctuated between 70.7 and 91.7 %. This also applied to the rates of resistance to most of the individual substances. Accordingly, the resistance rate for nalidixic acid/ciprofloxacin dropped to 29.5 %/37.2 % in 2009 from 62.1 %/67.7 % in 2008. Increases were recorded from 2008 to 2009 on the other hand in the rates of resistance to ampicillin to 61.5 %, streptomycin to 47.4 %, trimethoprim to 15.4 % and the cephalosporines cefotaxime and ceftazidime to 2.6 %.

Fig. 6.9: Resistance of selected *Salmonella* serovars from turkey meat to antimicrobial substances (2009)





(1) Multiresistant = resistant to more than one class of antimicrobials

6.5 Pork

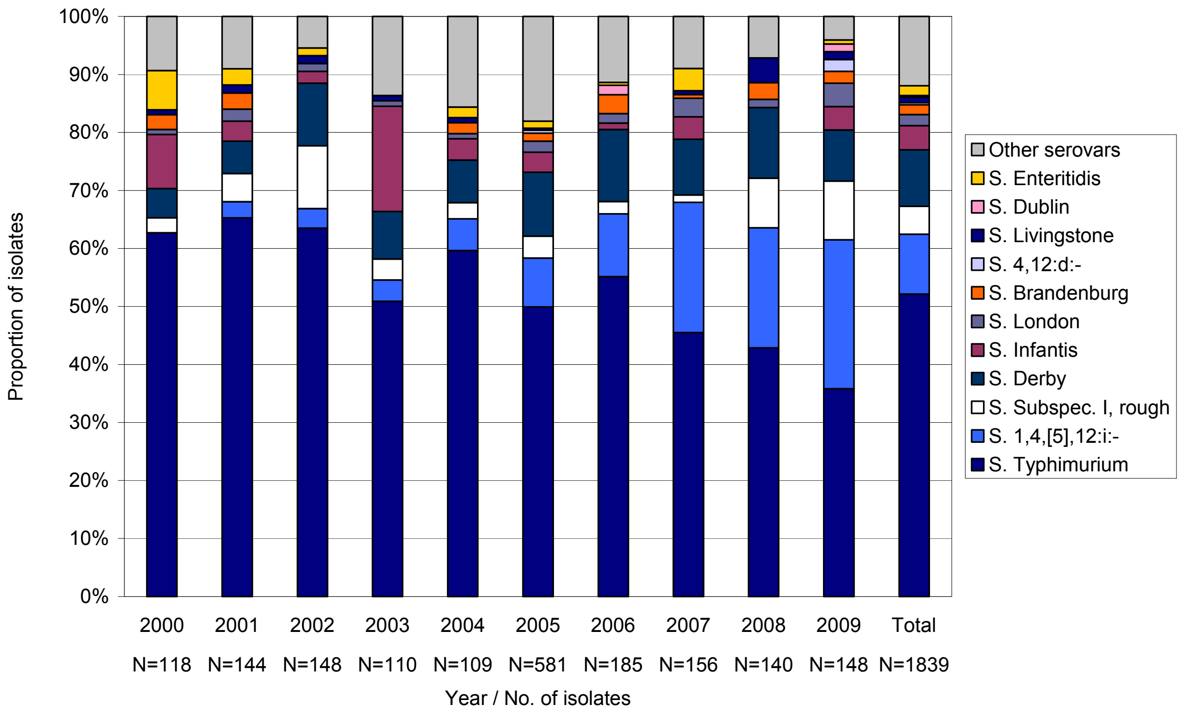
6.5.1 Serovars

The 1,839 *Salmonella* isolates from pork investigated in the period from 2000–2009 accounted for one fifth (20.1 %) of all isolates from meat. The annual proportion of *Salmonella* isolates from pork ranged from 109 isolates (6.4 %) in 2004 to 581 (34.4 %) in 2005. Overall, 40 different *Salmonella* serovars were identified. In the 148 isolates from pork in 2009, the predominant serovar was once again *S.* Typhimurium with 53 isolates (35.8 %), followed for the first time by monophasic *S.* Typhimurium *S.* 4,[5],12:i:- in second place. *S*. Subspec. I rough with 15 isolates (10.1 %), *S*. Derby with 13 isolates (8.8 %) and *S*. Infantis and *S*. London each with six isolates (4.1 %) took up the places 3 to 6 (Fig. 6.10).

6.5.2 Trend of the serovars

In 2009, the proportion of the predominant serovar *S.* Typhimurium (35.8 %) fell again by 7.1 % over 2008 (42.9 %). In contrast, the proportion of the monophasic serovar *S.* 4,[5],12:i:- continued to rise from 20.7 % in 2008 to 25.7 %. A slight increase was also recorded for the serovar *S*. Subspec. I rough to 10.1 % from 8.6 % in 2008. The proportion of *S*. Derby dropped to 8.8 % from 12.1 % in 2008 (Fig. 6.10).

Fig. 6.10: Proportions of the ten most frequent *Salmonella* serovars among the isolates from pork (2000–2009)



6.5.3 Serovar resistance

Of the 148 investigated isolates from pork, 102 (68.9 %) were resistant and 92 (62.2 %) multiresistant (Tab. 20.129). The highest rates of resistance were determined towards sulfamethoxazole (61.5 %), tetracycline (60.8 %), ampicillin (58.8 %) and streptomycin (55.4 %). The resistance rates to the other antimicrobial substances ranged from 16.2 % towards trimethoprim to 0 % to the cephalosporins cefotaxime and ceftazidime. The rates of resistance to the (fluoro)quinolones ciprofloxacin and nalidixic acid (2.7 % respectively) were also low (Tab. 20.130).

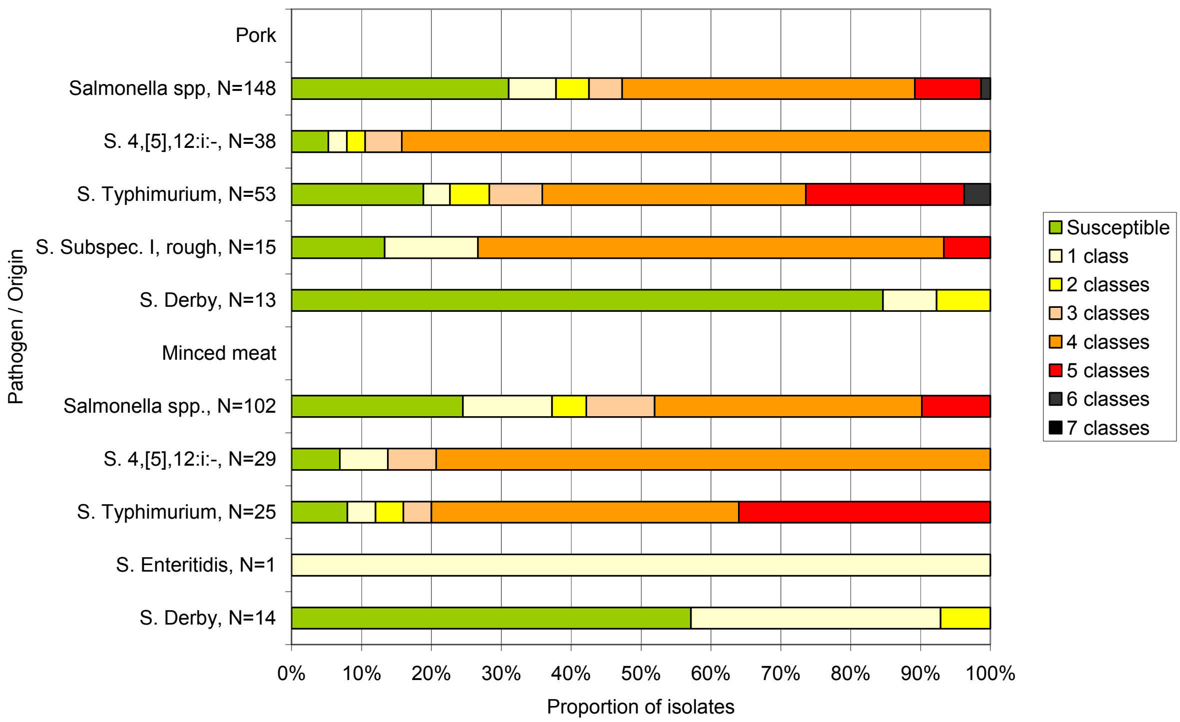
Of the 53 *S.* Typhimurium isolates from pork, 81.1 % (43 isolates) were resistant and 77.4 % (41 isolates) multiresistant. Compared to 2008, the number of resistant isolates was reduced by 15.6 % and those with multiple resistance by 5.9 % (Tab. 20.131). With the serovar dominant in pork, 37.7 % of the isolates showed quadruple resistance and 22.6 % pentaresistance. The *S.* Typhimurium isolates were particularly resistant to sulfamethoxazole (77.4 %), ampicillin (75.5 %), tetracycline (73.6 %) and streptomycin (60.4 %). Lower resistance rates were determined to chloramphenicol (32.1 %), florfenicol (28.3 %) and trimethoprim (26.4 %). The rate of resistance to the other aminoglycosides and (fluoro)quinolones ranged from 1.9 % (gentamicin) to 5.7 % (kanamycin, ciprofloxacin and nalidixic acid). To date the isolates have shown no resistance to the tested cephalosporins.

The monophasic *S*. Typhimurium moved into second place in terms of frequency with 38 isolates with a resistance rate of 94.7 % and a multiresistance rate of 92.1 %. Both rates are slightly higher than in 2008. 84.2 % of the isolates showed quadruple resistance. This can also be seen clearly with the individual substances, where sulfamethoxazole with 92.1 % and ampicillin, streptomycin and tetracycline each with 89.5 % showed the highest resistance rates. The isolates were susceptible to all other substances with the exception of kanamycin (2.6 %).

With a slightly higher number of 15 isolates (10.1 %) compared to 2008, *S*. Subspec. I rough came in third where frequency was concerned. Of these isolates, 86.7 % were resistant and 73.4 % multiresistant. Multiresistance only occurred as quadruple (66.7 %) or pentaresistance (6.7 %). This was also reflected in individual substances, with tetracycline (86.7 %), as well as ampicillin, streptomycin and sulfamethoxazole, (73.3 % each), showing the highest values. Further resistances were only detected towards trimethoprim (26.7 %) and chloramphenicol (6.7 %).

Compared to the *S.* Typhimurium isolates from pork, only the *S.* Derby isolates showed a lower resistance rate in 2009, as in the previous years. Of the 13 isolates, 15.4 % were resistant and 7.7 % multiresistant (Tab. 20.133). Yet again, a statement on the trend of resistance is not possible due to the small number of isolates in 2009. Resistance to sulfamethoxazole and trimethoprim (15.4 % each) and streptomycin (7.7 %) was identified. The isolates were susceptible to all other antimicrobial substances tested.

Fig. 6.11: Resistance of selected *Salmonella* serovars from minced meat and pork to antimicrobial substances (2009); Number of classes of antimicrobials the isolates were resistant to

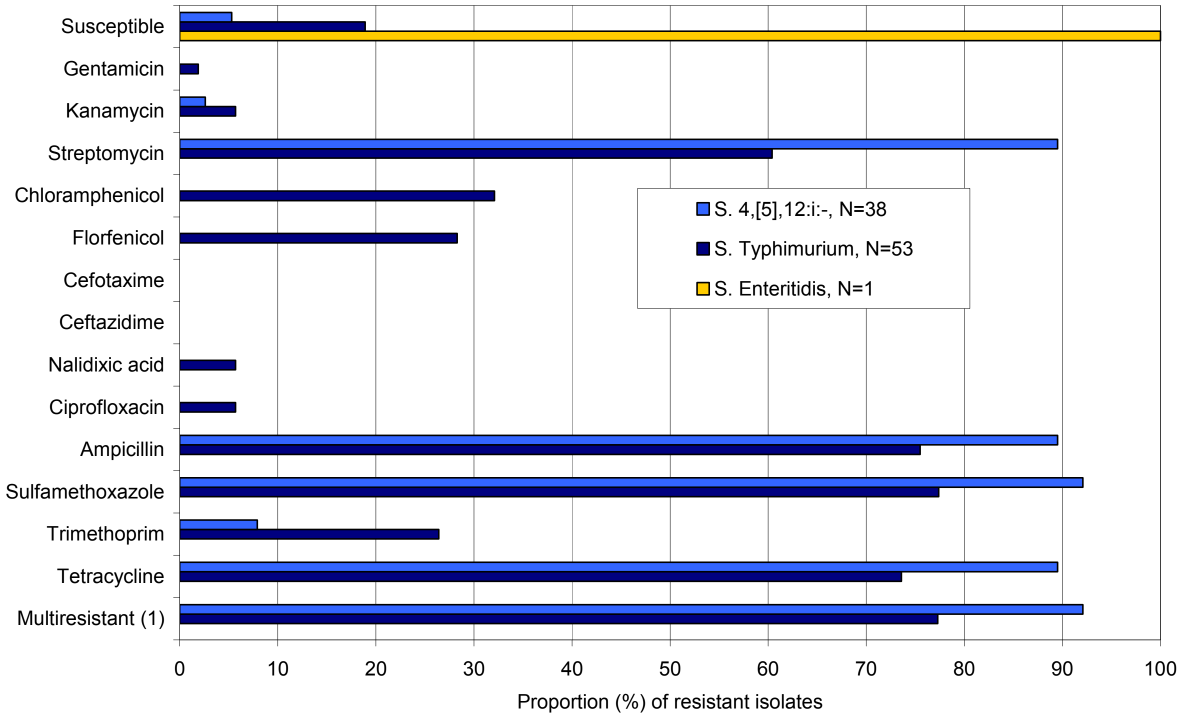


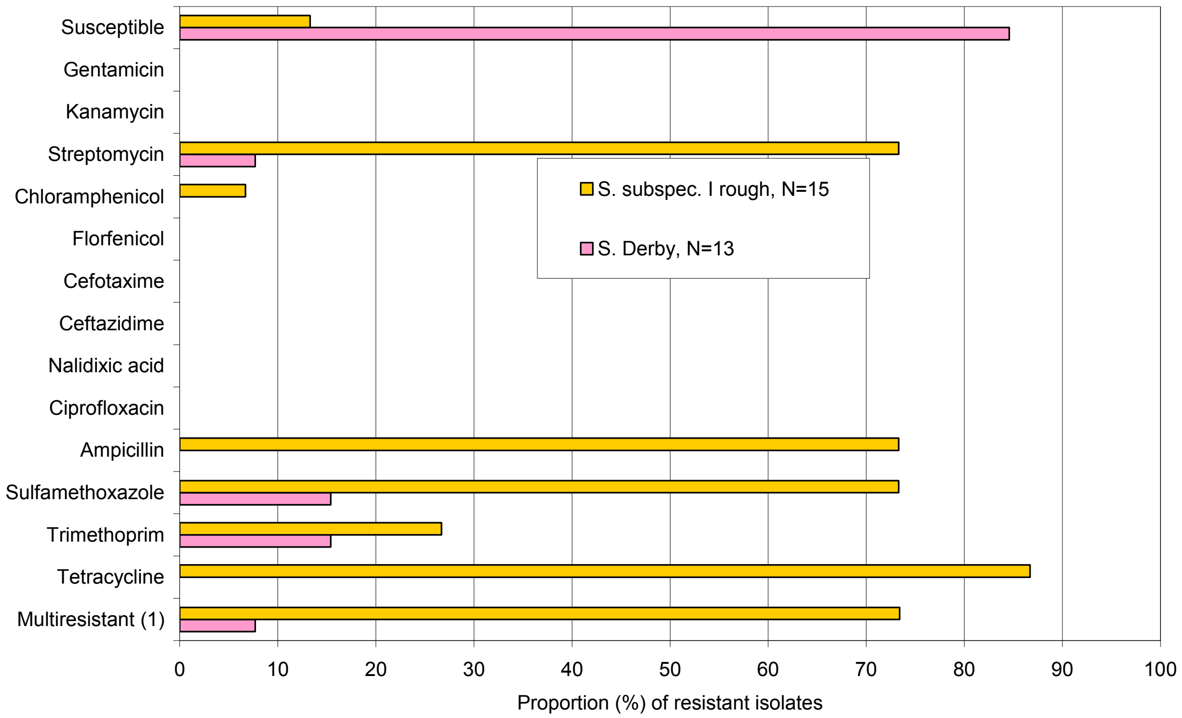
With six isolates each, *S.* Infantis and *S.* London were the fifth most common serovars in pork in 2009. All isolates of *S.* London were susceptible to all 13 antimicrobial substances tested and only two (33.3 %) of the *S.* Infantis isolates were resistant to streptomycin or ciprofloxacin and nalidixic acid (16.7 % respectively).

6.5.4 Trend of resistance

With 148 investigated isolates, the number was on a similarly high level as the previous years. The proportion of resistant *Salmonella* isolates in pork decreased to 68.9 % from 76.4 % in 2008. This also applied to a lesser extent to multiresistant isolates, the proportion of which amounted to 62.2 % in 2009 (- 3.5 % over 2008) (Tab. 20.130). The resistance rates also dropped for most of the single substances compared to the values of 2008. The exceptions were streptomycin which increased to 55.4 % (+ 2.5 %) and trimethoprim which reached 16.2 % (+ 2.6 %). The predominance of quadruple resistance (60.8 % of all resistant isolates, mainly to streptomycin, ampicillin, tetracycline and sulfamethoxazole) with *Salmonella* isolates from pork continued in 2009.

Fig. 6.12: Resistance of selected *Salmonella* serovars from pork to antimicrobial substances (2009)





(1) Multiresistant = resistant to more than one class of antimicrobials

6.6 Minced meat

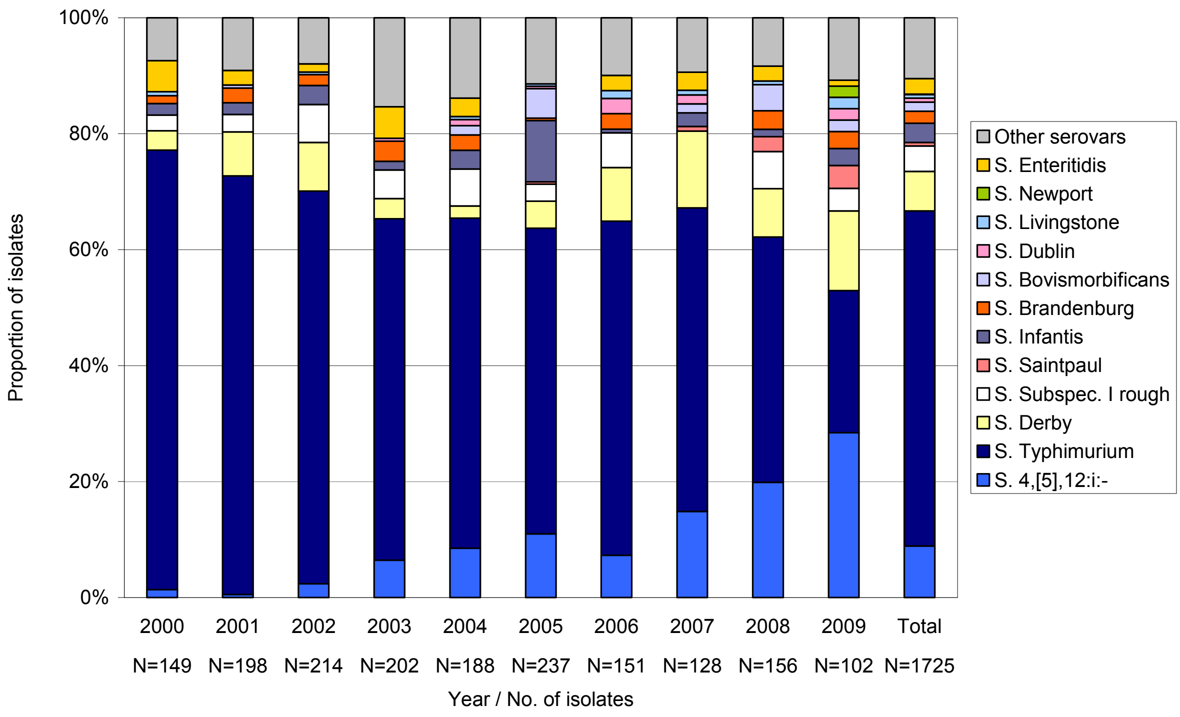
6.6.1 Serovars

The designation of origin "minced meat" only includes *Salmonella* isolates from mixtures of minced pork and beef, for which clear categorisation to one of the two species was not possible. Pure pork and beef mince were categorised as pork and beef respectively. A total of 1,725 isolates have been investigated since 2000, a proportion of 18.8 % of the total isolates from meat. The annual number varied between 128 (7.9 %) and 237 (14.6 %) of all food isolates with 102 isolates (11.2 %) submitted to the NRL in 2009. 43 different serovars were detected. The monophasic *S*. Typhimurium (*S*. 4,[5],12:i:-) was predominant in 2009 with 29 isolates (28.4 %), followed by *S.* Typhimurium with 25 (24.5 %) and *S.* Derby with 14 (13.7 %). Only four isolates each (3.9 %) of *S*. Saintpaul and *S*. Subspec. I rough were detected (Fig. 6.13).

6.6.2 Trend of the serovars

Monophasic *S*. Typhiumurium was the predominant serovar in minced meat for the first time in 2009. The proportion of *S.* Typhimurium dropped from 42.3 % in 2008 to as little as 24.5 %. The proportion of *S*. Derby isolates increased to 13.7 % in 2009 from 8.3 % in 2008. Due to the low numbers of isolates of the serovars which followed in order of frequency, no clear trend could be established for them (Tab. 20.121).

Fig. 6.13: Proportion of the ten most frequent *Salmonella* serovars among the isolates from minced meat (2000–2009)



6.6.3 Serovar resistance

Of the 102 isolates investigated for their resistance, 77 (75.5 %) were resistant and 64 (62.7 %) multiresistant (Fig. 6.14). Of the 77 resistant isolates, more than half (39) showed quadruple resistance. This can also be seen clearly with the single resistances with which tetracycline (61.8 %), ampicillin (60.8 %), sulfamethoxazole (58.8 %) and streptomycin (50.0 %) had the highest rates (Tab. 20.147).

With the monophasic serovar of *S.* Typhimurium which was predominant in minced meat for the first time (29 isolates), 93.1 % of the isolates were resistant and 86.2 % multiresistant. The proportion of resistant isolates was always very high with this serovar and fluctuated from 2003 with more than ten isolates per year between 84.6 % (2003) and 100 % (2006), but was over 93 % in most years. This serovar showed a distinct quadruple resistance (79.3 %), which was also reflected in the resistance rates of the single substances which lay at 86.2 % respectively towards the single substances sulfamethoxazole, tetracycline, ampicillin and streptomycin. With the exception of trimethoprim with 3.4 %, the isolates were susceptible to all other antimicrobial substances tested (Tab. 20.152).

Of the 25 *S*. Typhimurium isolates, 92 % were resistant and 88 % multiresistant. In addition to the quadruple resistance which was also distinctive with this serovar (44 %), pentaresistance was also detected frequently (36 %). This is also reflected in the single substances: ampicillin (92.0 %), sulfamethoxazole (88.0 %), tetracycline (84.0 %), streptomycin (68.0 %), chloramphenicol (48.0 %), florfenicol (40.0 %) and trimethoprim (32.0 %). A resistance of only 8 % was only observed towards kanamycin. The isolates were susceptible to all other antimicrobial substances tested.

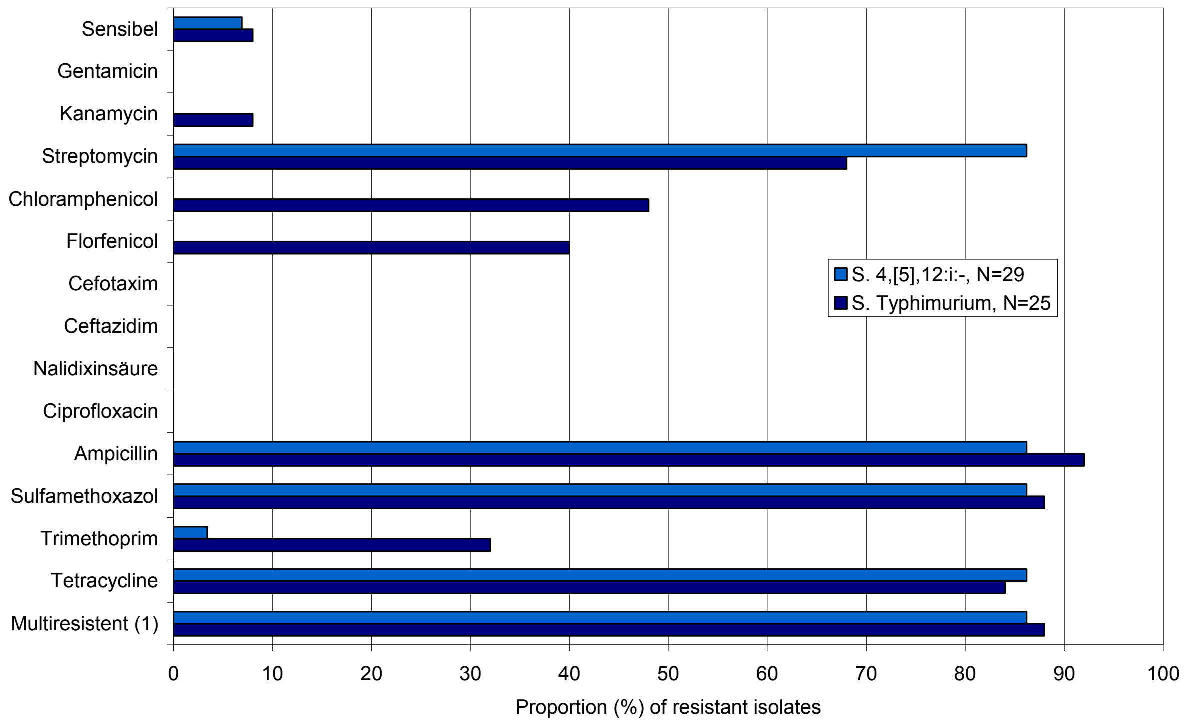
S. Derby was the third most common serovar in minced meat with 14 isolates in 2009. 42.9 % of the isolate were resistant here and only 7.1 % multiresistant (Tab. 20.151). A steady increase of resistant isolates has been recorded with *S*. Derby isolates since 2005, whereby multiresistances occurred less often. This was also reflected in the resistance rates to the single substances which showed much lower values in comparison with the two aforementioned serovars: tetracycline (28.6 %), sulfamethoxazole and trimethoprim (14.3 % each) and ampicillin (7.1 %). The isolates were susceptible to all other antimicrobial substances tested.

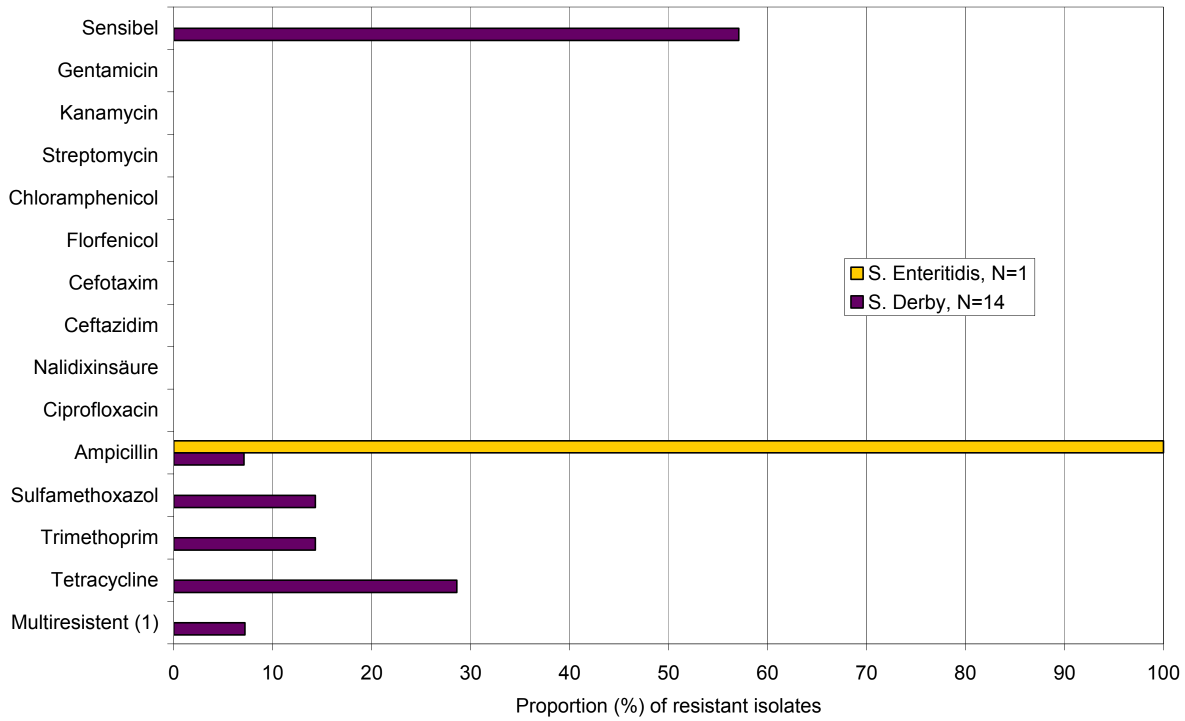
The serovars *S*. Saintpaul and *S*. Subspecies I rough then follow with four isolates each, all but one of which were multiresistant. No resistance percentage is given here due to the small number of isolates.

6.6.4 Trend of resistance

The percentage of resistant isolates remained constant in 2009 compared to 2008, but with 75.5 % it was above the average for the years 2000–2009 (69.2 %). Although the proportion of multiresistant isolates dropped slightly from 66 % in 2008 to 62.7 % in 2009, it was still well above the average for 2000–2009 of 54.7 %. For most of the individual substances, the resistance rate fell slightly compared to the values for 2008 or remained unchanged. An increase was only observed with gentamicin (to 2.0 %), trimethoprim (to 17.6 %) and tetracycline (to 61.8 %), whereas a decrease of 6.8 % was recorded with chloramphenicol (13.7 %) and 9.4 % with florfenicol (9.8 %) compared to 2008.

Fig. 6.14: Resistance of selected *Salmonella* serovars from minced meat to antimicrobial substances (2009)





(1) Multiresistant = resistant to more than one class of antimicrobials

6.7 Beef

Because only nine different serovars were detected in the 26 isolates of beef, individual observation does not appear practicable. 61.5 % of the isolates were resistant and 46.1 % multiresistant.

7 Comparison of the resistance rates of important serovars in livestock and food obtained from livestock

The contamination of food, especially meat, with *Salmonella* spp. is often caused by cross-contamination from living animals to carcasses during slaughter. Because of this it is useful to compare the resistance rates of specific serovars between isolates from animals and isolates from the meat of these animals. The results of this comparison are presented in the following chapter. Due to their special importance to human beings, the focus is on isolates of *S.* Enteritidis and *S.* Typhimurium. Moreover, it was possible to isolate them from all animal species. In three other chapters, serovars that occurred mainly in one animal species are compared with meat from this animal species.

Isolates from cattle and from beef were not compared, as the total number of isolates from beef was low.

7.1 Serovar distribution

The proportions of the most important serovars in the total of isolates from animals and from the meat of these animal species were partially very similar (pigs, turkeys). The isolates from chicken and from chicken meat were different as the monophasic serovar *S.* 4.12:d:- was much less common and serovar *S*. Paratyphi B dT+ was much more common in chicken meat than in chicken. These differences, as well as the differences in serovar resistance between chicken and chicken meat discussed in the following chapters, is explained in part by the fact that isolates from chicken can originate from all areas of production (breeding, laying hens and broilers), while isolates from chicken meat mainly originate from broilers. Furthermore, meat import from other EU member states and/or third countries may have contributed to the differences in the resistance patterns

7.2 *S.* Enteritidis from livestock and the meat of these animals

Overall, *S.* Enteritidis showed low resistance rates. Isolates from chicken meat showed resistances more often than those from animals. No resistances to fluoroquinolones or third generation cephalosporins were determined in either origin in 2009.

This comparison is not presented here due to the relatively small number of *S.* Enteritidis isolates from pork (N=29) and turkey meat (N=9).

Fig. 7.1: Serovar distribution in livestock species and meat thereof (2009)

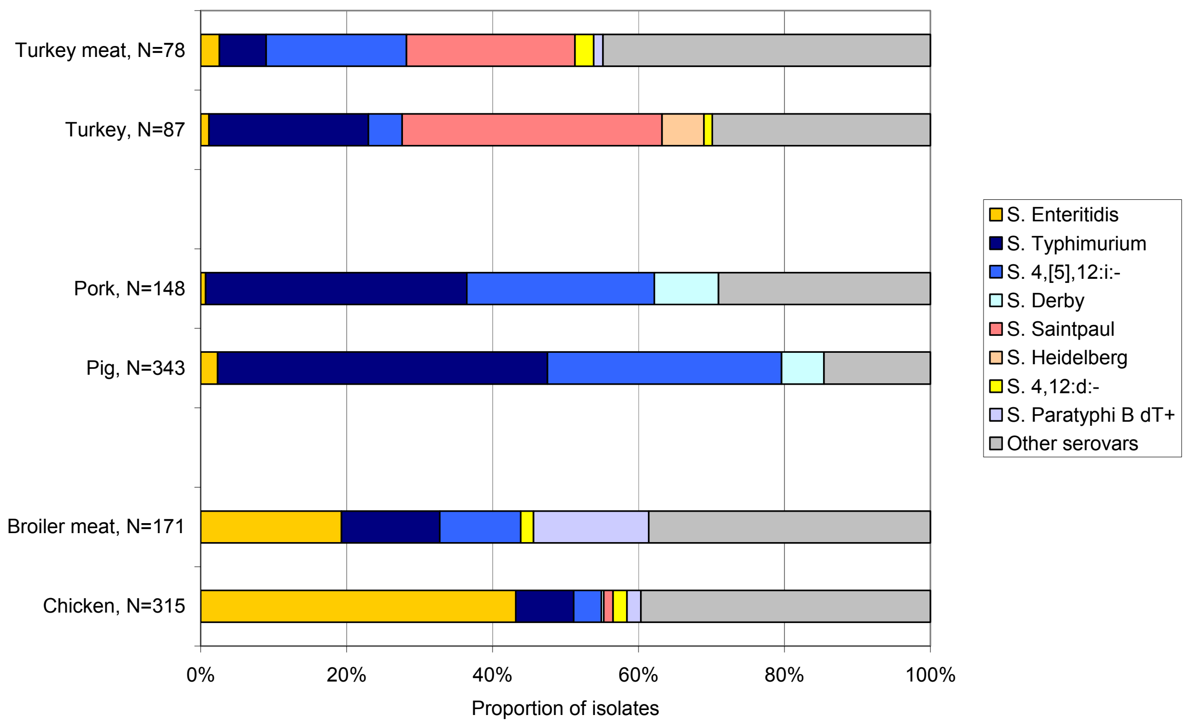
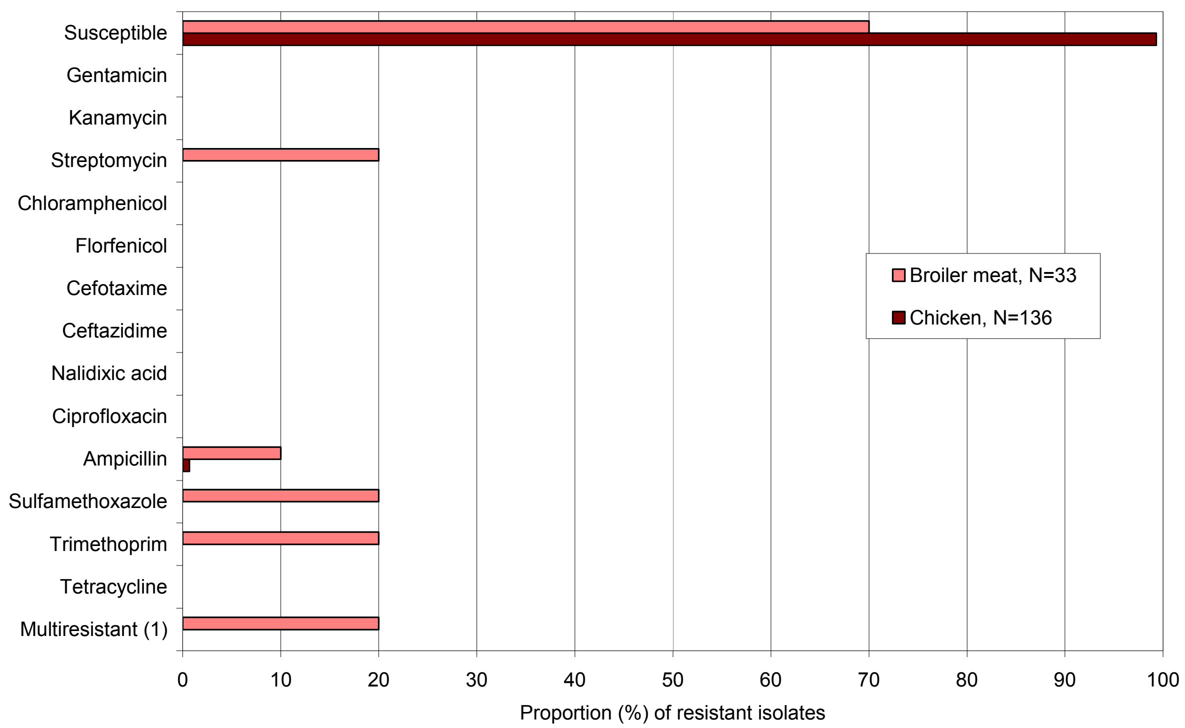


Fig. 7.2: Resistance rates of *S.* Enteritidis from chicken and chicken meat (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

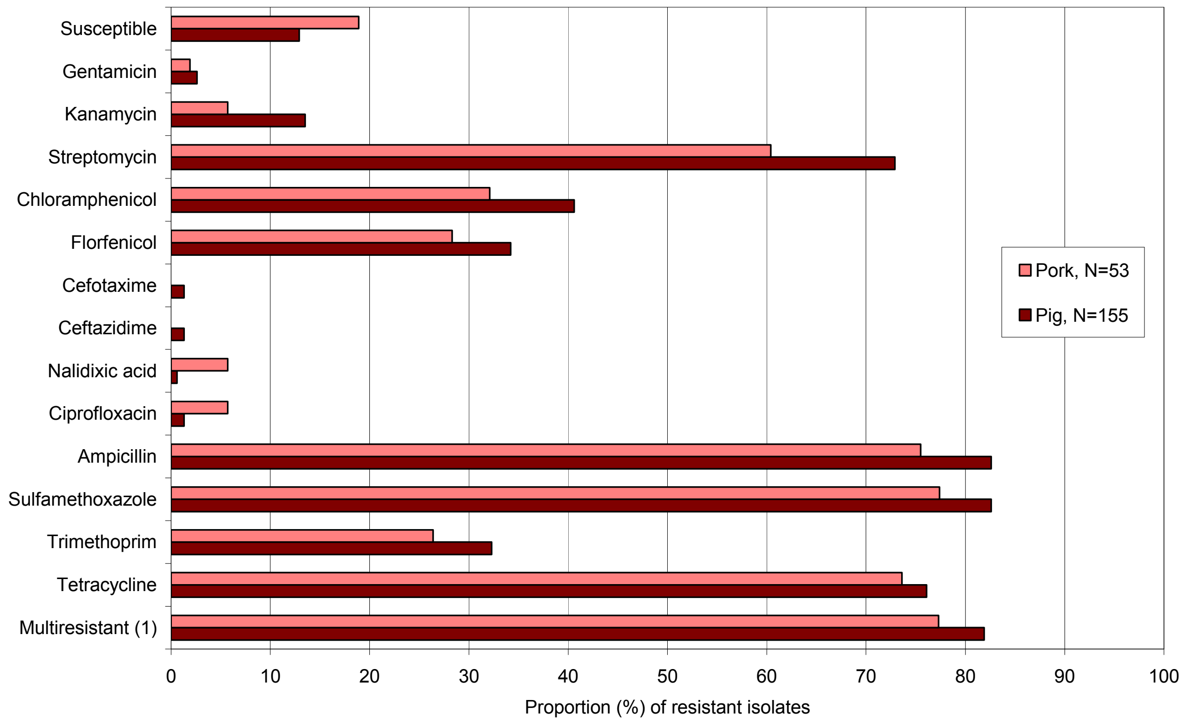
7.3 *S.* Typhimurium from livestock and the meat of these animals

Isolates from pigs showed higher resistance rates than isolates from pork (Fig. 7.3). With 81.1 %, the proportion of resistant isolates was slightly lower in food than in samples from pigs (87.1 %), as was the proportion of multiresistant isolates with 77.3 % to 81.9 %. This difference can be seen in all single substances too, with the exception of the fluoroquinolones. In the latter, no resistance was determined in isolates from pigs, whereas three isolates from pork were resistant (5.7 %).

In chickens, significantly more isolates from the meat were resistant (52.2 %) than from the animal (20 %) (Fig. 7.4). This also applied to all substances with the exception of trimethoprim where two isolates from the animal and only one from the meat were resistant.

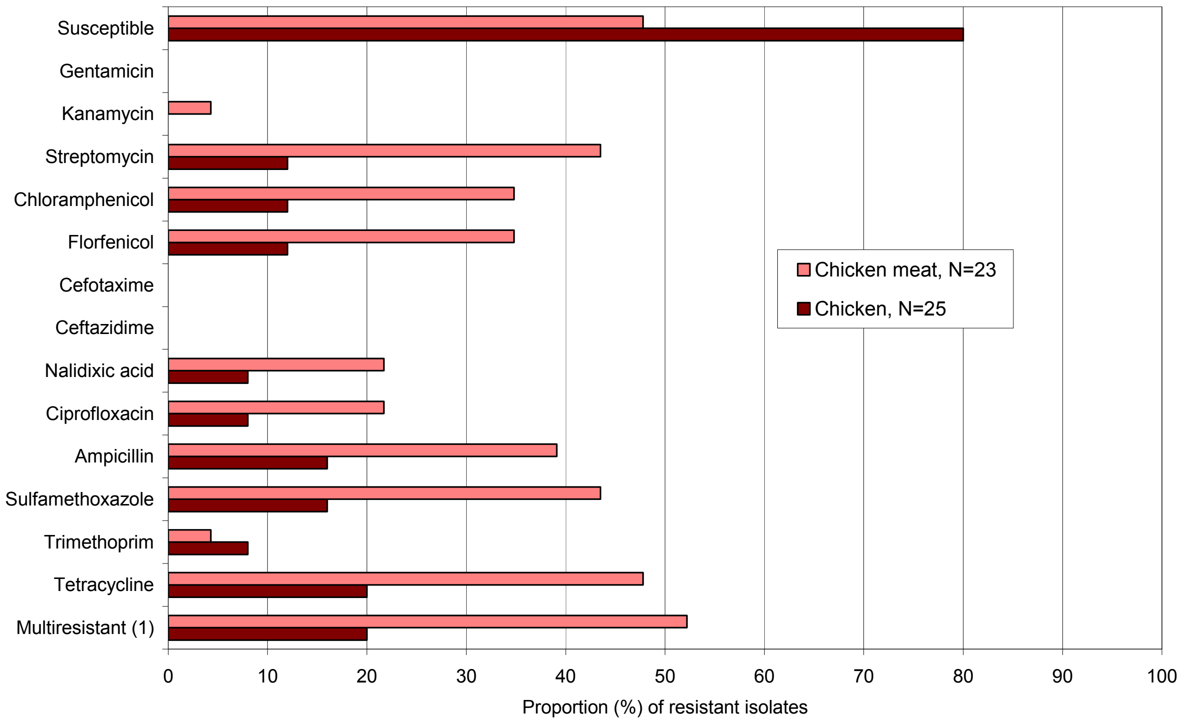
It was not possible to make a comparison for cattle and turkey in 2009 because there were too few (< 10) isolates from meat.

Fig. 7.3: Resistance rates of *S.* Typhimurium from pigs and pork (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

Fig. 7.4: Resistance rates of *S.* Typhimurium from chicken and chicken meat (2009)



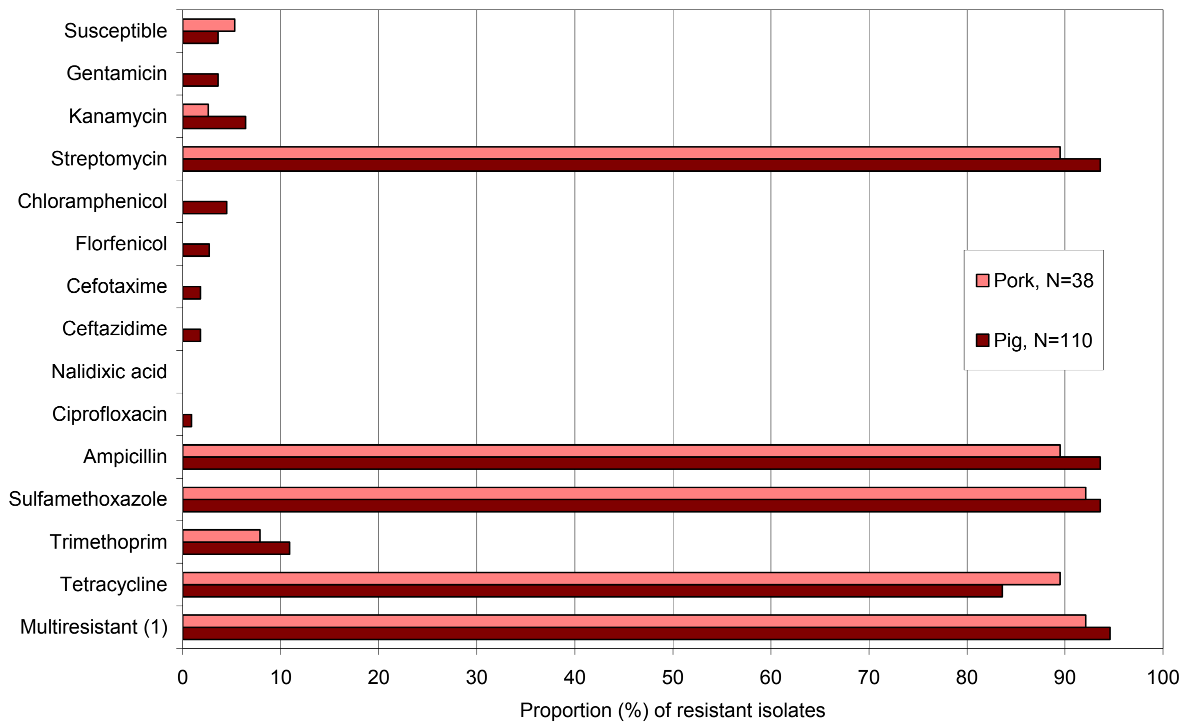
(1) Multiresistant = resistant to more than one class of antimicrobials

7.4 *S.* 4,[5],12:i:- from livestock and the meat of these animals

The proportion of resistant isolates from pork (94.7 %) was about the same as the proportion of isolates from pigs (96.4 %) (Figure 7.5). The proportion of multiresistant isolates was also comparable in both origins (92.1 % vs. 94.6 %). For individual substances too, the proportions of resistant isolates varied by only a few percentage points, but the isolates from animals showed more resistance to more different substances in some cases.

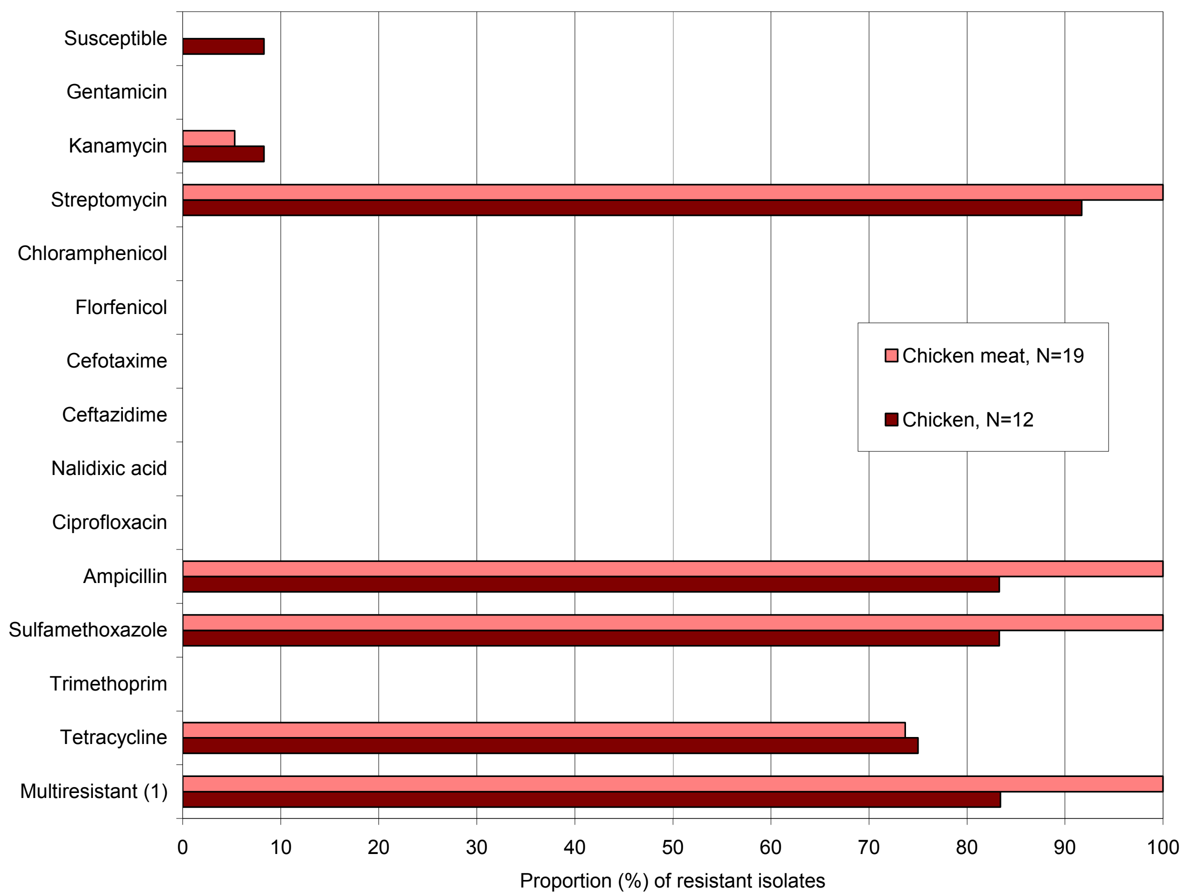
Similar to *S.* Typhimurium, the proportion of resistant isolates of *S.* 4,[5],12:i:- in chicken meat was higher (100 %) than in the animal itself (91.7 %) (Fig. 7.6). The difference existed mainly for streptomycin, ampicillin and sulfamethoxazole. The percentage of resistances to kanamycin and tetracycline were slightly higher in the animals. These differences should be interpreted with caution due to the small number of isolates (12 and 19 respectively).

Fig. 7.5: Resistance rates of *S.* 4,[5],12:i:- from pigs and pork (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

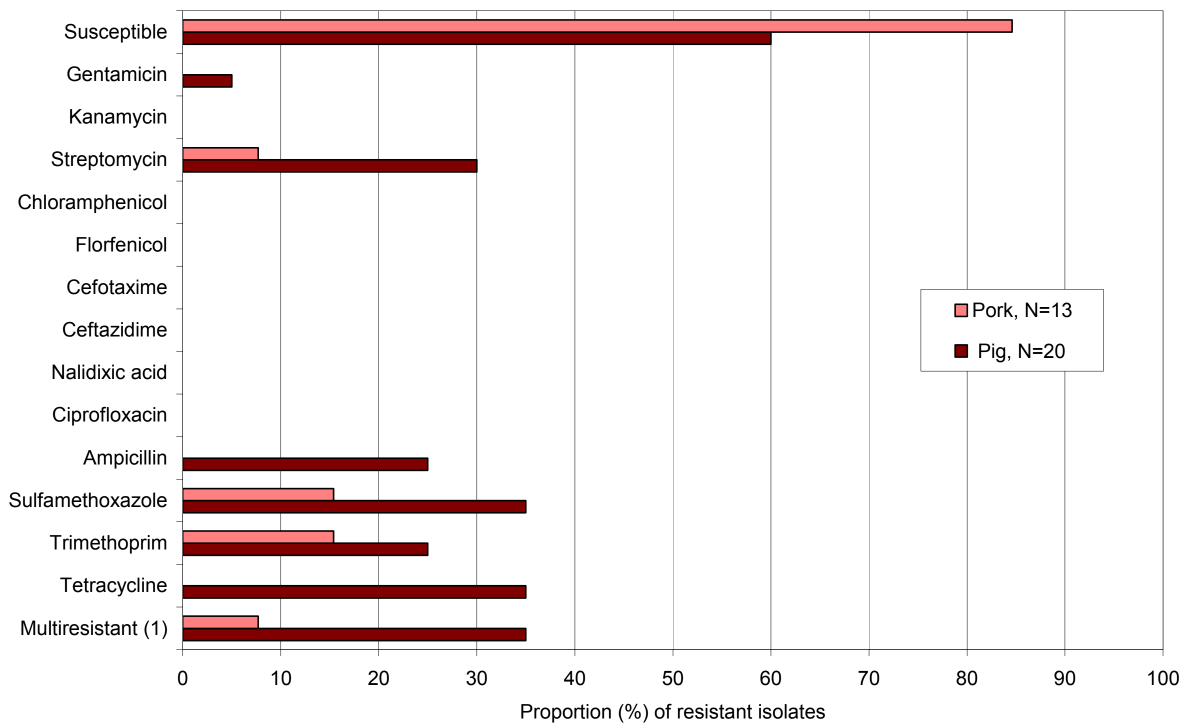
Fig. 7.6: Resistance rate of *S.* 4,[5],12:i:- from chicken and chicken meat (2009)



7.5 *S.* Derby from pigs and pork

S. Derby isolates from pigs were considerably more often resistant than isolates from pork (40 vs. 15 %). In line with that the proportion of resistant isolates from pigs was higher in most substances than in those from food (Fig. 7.7). The results match up with the results from the years 2000–2008.

Fig. 7.7: Resistance rates of *S.* Derby from pigs and pork (2009)

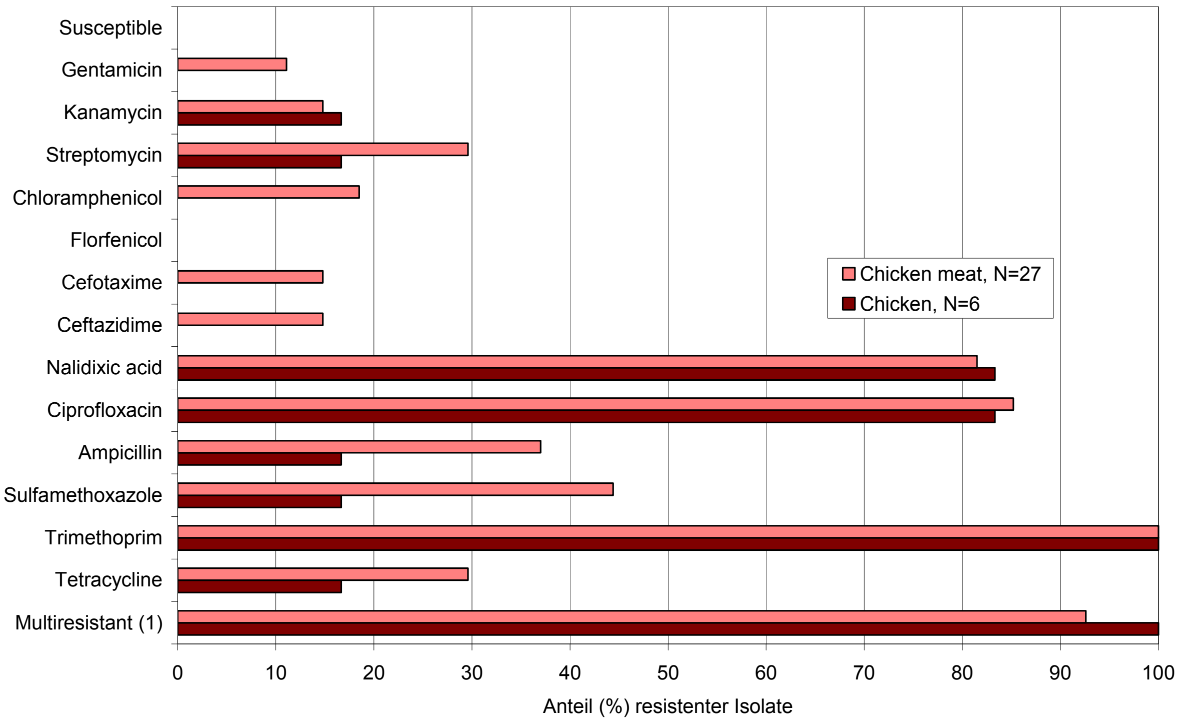


(1) Multiresistant = resistant to more than one class of antimicrobials

7.6 *S.* Paratyphi B dT+ from chicken and chicken meat

S. Paratyphi B dT+ from chicken and chicken meat were resistant without exception (Fig. 7.8). Only six isolates from the animals were available, however, so that a valid comparison between the isolates of the animal and the meat was not possible. Isolates of this serovar were also resistant in the period 2000–2008.

Fig. 7.8: Resistance rate of *S.* Paratyphi B dT+ from chicken and chicken meat (2009)

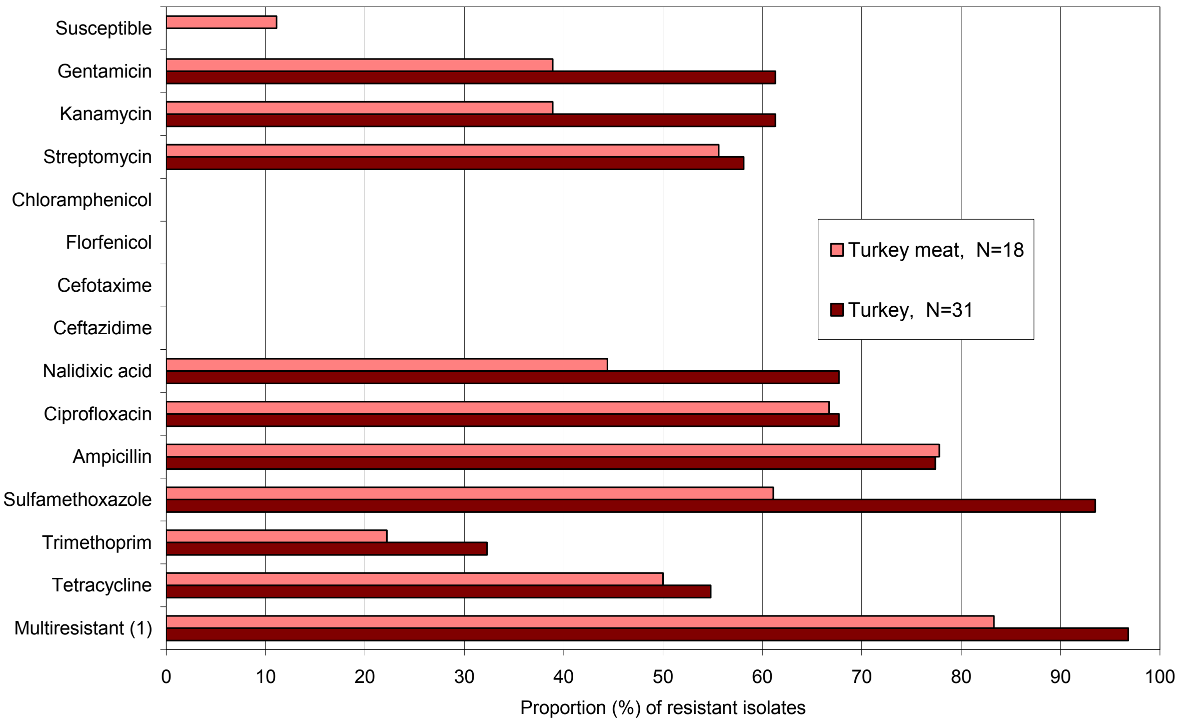


(1) Multiresistant = resistant to more than one class of antimicrobials

7.7 *S.* Saintpaul from turkeys and turkey meat

Overall, *S.* Saintpaul from turkey meat showed less resistance to antimicrobials than isolates of this serovar from turkeys (Fig. 7.9). Accordingly, the proportion of susceptible isolates in turkey meat was higher (11 % vs. 0 %) and the proportion of resistant isolates lower (83.3 % vs. 96.8 %). This difference was also observed to varying degrees with the single substances. The results match up with those from the years 2000–2008.

Fig. 7.9: Resistance rate of *S.* Saintpaul from turkeys and turkey meat (2009)



(1) Multiresistant = resistant to more than one class of antimicrobials

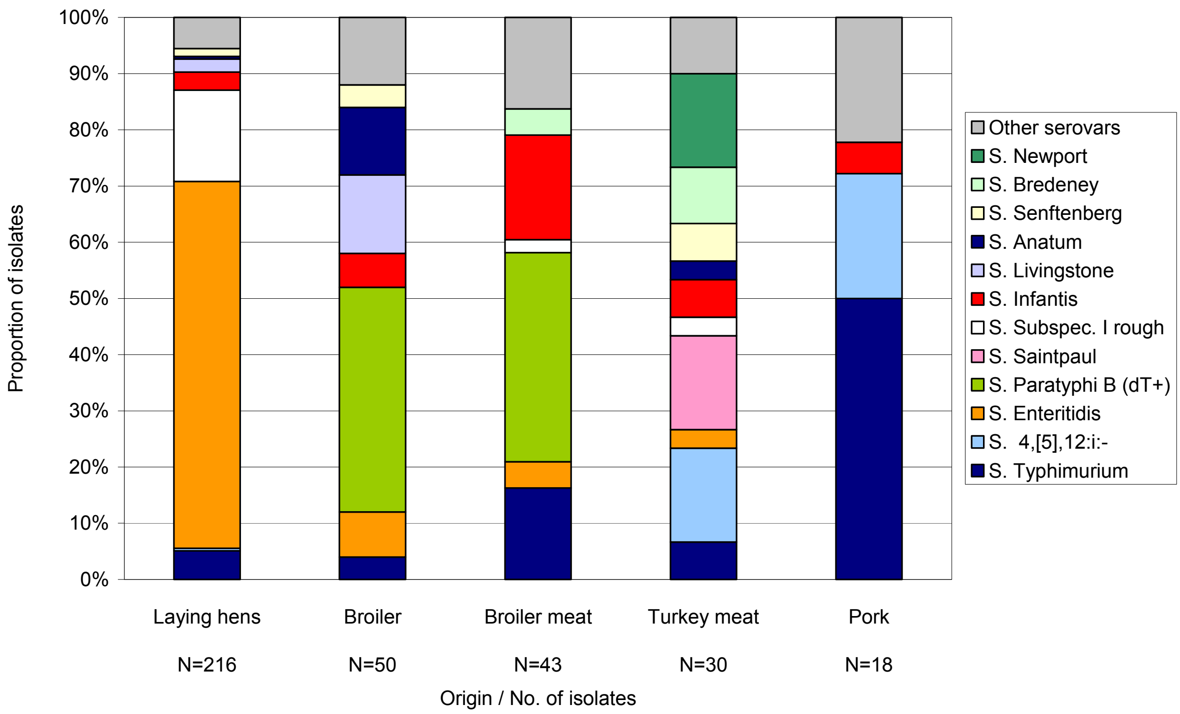
8 *Salmonella* isolates from zoonosis monitoring 2009

8.1 Introduction

Within the scope of zoonosis monitoring and control programmes in accordance with Reg. (EC) No. 2160/2003, samples from various matrices were tested for *Salmonella*. A total of 358 *Salmonella* isolates were submitted to the NRL Salm and could be assigned to one of the proposed monitoring programs and control programmes for laying hens and broilers. After serotyping, they were tested for their resistance to antimicrobial substances. The majority of the isolates originated from the control programme for laying hens (N=216).

The *Salmonella* isolates differed between the origins with regard to the proportion of the various serovars as well as their resistance to antimicrobial substances (Fig. 8.1). In the following chapter, the results of the tests conducted on isolates from laying hens and broilers are presented, followed by those from the meat of chicken, turkeys, calves and pigs.

Fig. 8.1: Proportion of the serovares in *Salmonella* isolates from zoonosis monitoring (2009)



8.2 Isolates from animals

8.2.1 Laying hens

Among the isolates from flocks of laying hens, *S.* Enteritidis was by far the most frequently submitted serovar (65.3 %), followed by *S.* Subspec. I rough (16.2 %) and *S.* Typhimurium (5.1 %). The monophasic variant of *S.* Typhimurium, *S.* 4,[5],12:i:-, was only submitted once. The serovars *S.* Infantis and *S.* Virchow, which are addressed in the control programmes for breeding flocks of chickens, were also submitted several times (3.2 and 0.9 % respectively).

Of the 216 isolates submitted, only 16 (7.4 %) proved to be resistant, 12 of them (5.6 %) to more than one substance class (Fig. 8.2). Most of the isolates from laying hens were susceptible (92.6 %). This applied in particular to the isolates of the serovars *S.* Enteritidis where resistance was determined once each to fluoroquinolones, trimethoprim, gentamicin and sulfamethoxazole. All isolates of *S.* Subspec. I rough were susceptible.

Resistance was frequently observed to the antimicrobials streptomycin, sulfamethoxazole, ampicillin and tetracycline (eight to ten isolates respectively). Most of these isolates belonged to the serovar *S.* Typhimurium. Of the resistant isolates, four showed a pentaresistance to streptomycin, chloramphenicol, sulfamethoxazole, ampicillin and tetracycline. These four isolates all belonged to the serovar *S.* Typhimurium. The isolates with triple resistance also belonged to *S.* Typhimurium (two isolates) or its monophasic variant (one isolate).

Fig. 8.2: Resistance of selected serovars from laying hens and broiler to antimicrobial substances (2009). Number of classes of antimicrobials the isolates were resistant to

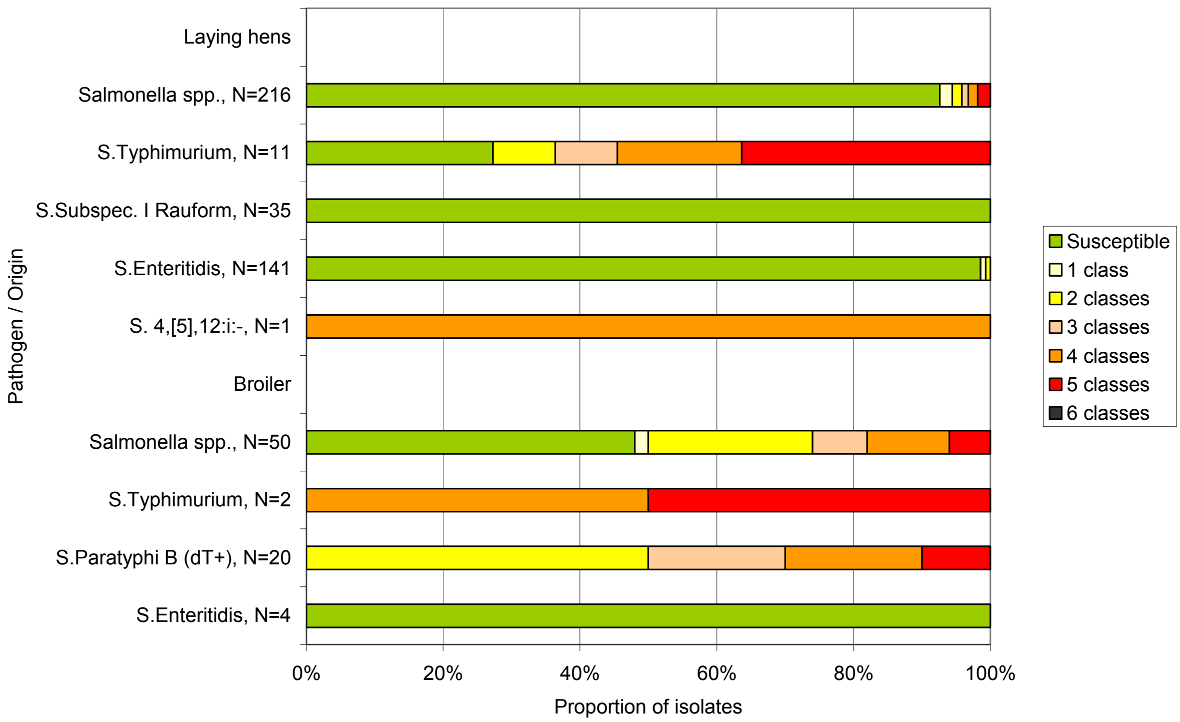


Fig. 8.3: Resistance of *Salmonella* isolates from laying hen flocks to antimicrobial substances (2009)

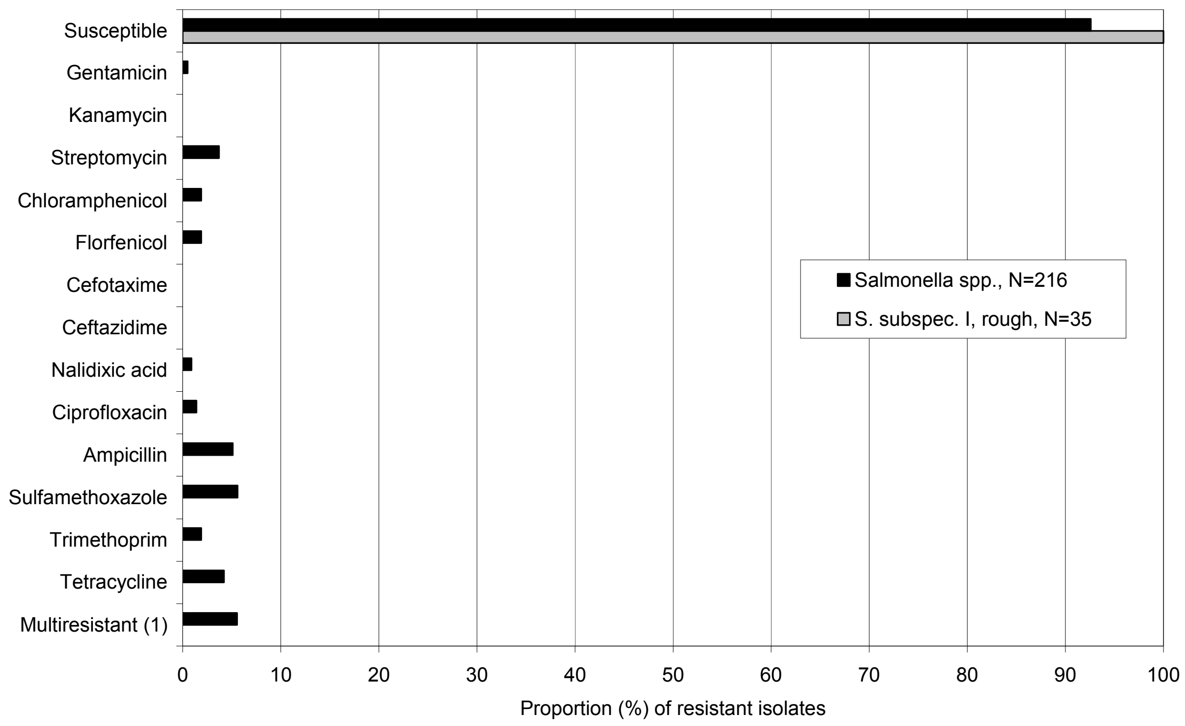
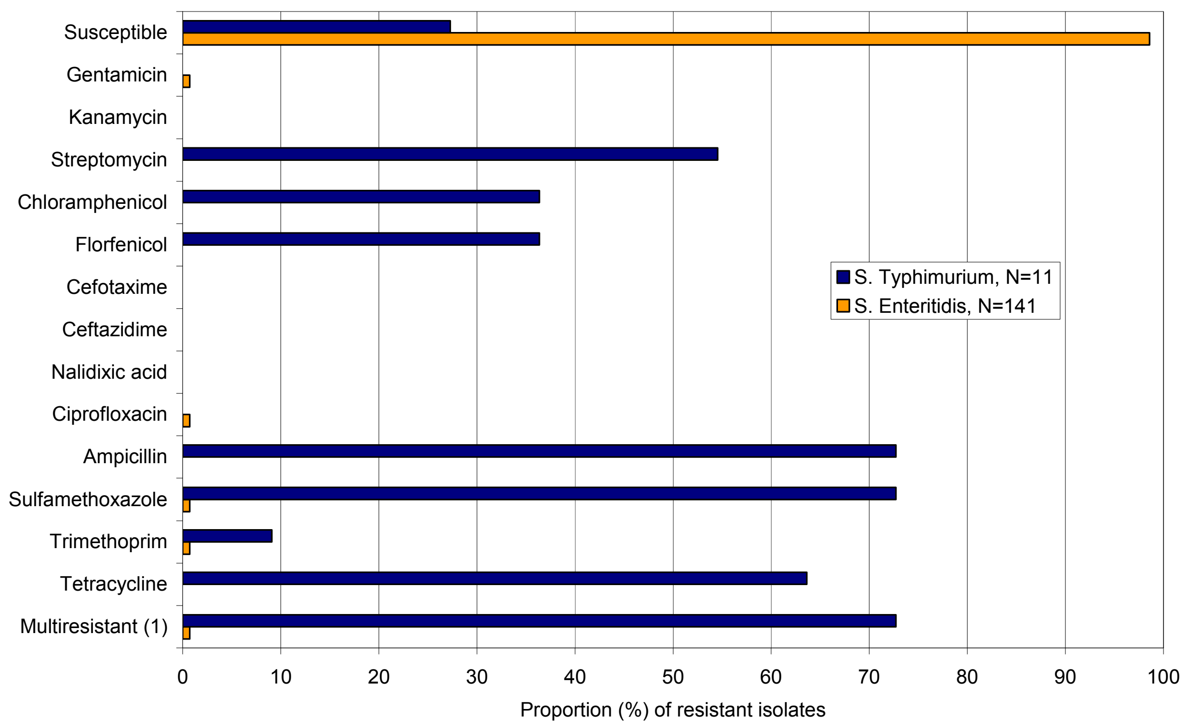


Fig. 8.4: Resistance of *Salmonella* isolates from laying hen flocks to antimicrobial substances (2009)



8.2.2 Broilers

Of the 50 broiler isolates submitted, 40 % belonged to the serovar *S.* Paratyphi B dT+ (Fig. 8.1). Other common serovars were *S.* Livingstone (14 %) and *S.* Anatum (12 %). The serovars mentioned in the control programme, *S.* Enteritidis (8 %) and *S.* Typhimurium (4 %), were also submitted. The monophasic variant of *S.* Typhimurium, *S.* 4,[5],12:i:-, was not submitted. Of the other serovars subject to mandatory control with breeding flocks of chicken, only *S.* Infantis was detected (6 %).

Of the isolates submitted, a total of 52 % were resistant (Fig. 8.5). 50 % of the isolates showed multiple resistance, 20 of the 25 multiresistant isolates belonged to the serovar *S.* Paratyphi B dT+ which was multiresistant in all cases. In addition to resistance to sulfamethoxazole, trimethoprim, tetracycline and ampicillin, resistance to fluoroquinolones was also observed frequently. Resistance to fluoroquinolones, however, was observed almost exclusively with the serovar *S.* Paratyphi B dT+ (16 of the 17 resistant isolates). The isolate resistant to third generation cephalosporins also belonged to this serovar. The four isolates of *S.* Enteritidis were susceptible. Of the two *S.* Typhimurium isolates, one showed a pentaresistance to streptomycin, chloramphenicol, sulfamethoxazole, ampicillin and tetracycline. The other was susceptible to the phenicols but resistant to the other four antimicrobial substance classes (Fig. 8.6).

No resistance was observed to the two aminoglycosides gentamicin and kanamycin.

Fig. 8.5: Resistance of *Salmonella* isolates from broiler flocks to antimicrobial substances (2009)

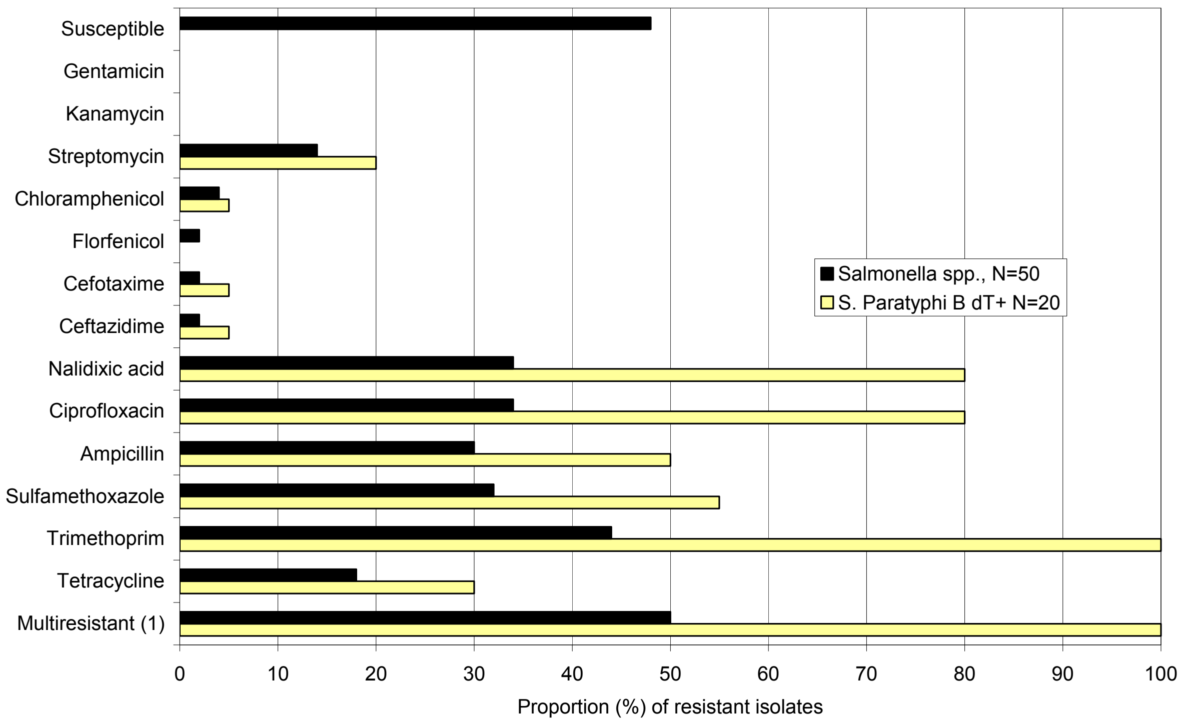
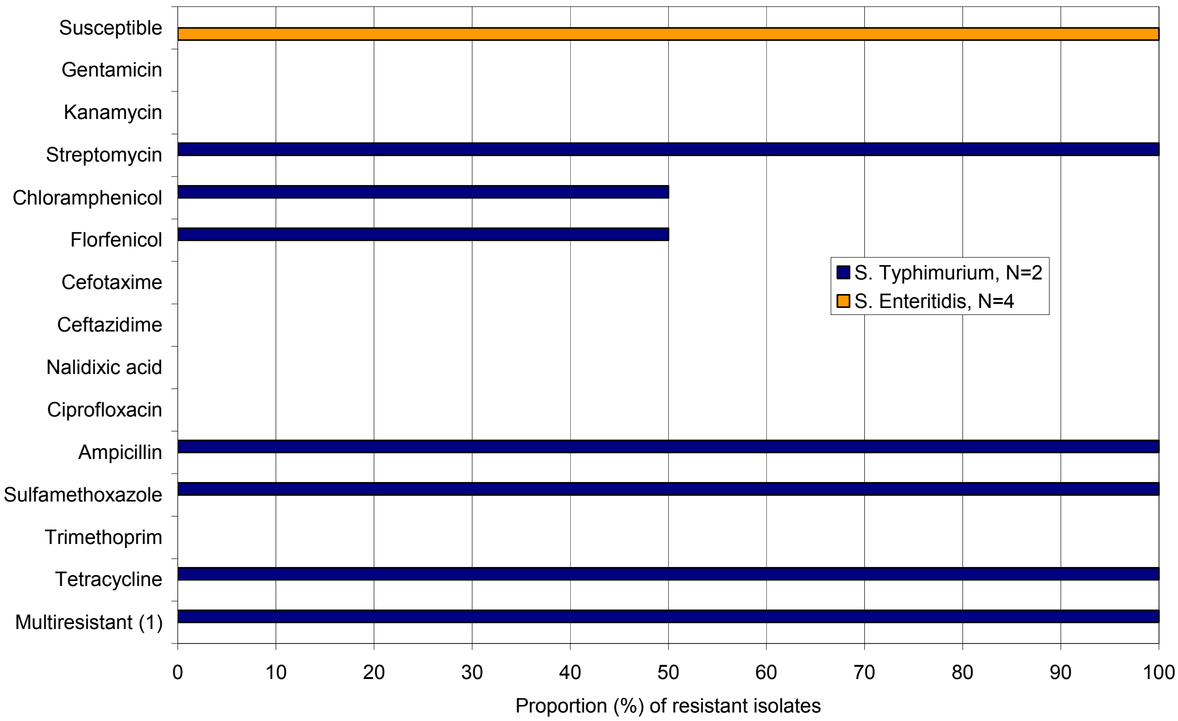


Fig. 8.6: Resistance of *Salmonella* isolates from broiler flocks to antimicrobial substances (2009)



8.3 Isolates from food

8.3.1 Chicken meat

43 isolates from chicken meat were submitted for resistance testing. As with broilers, the predominant serovar was *S.* Paratyphi B dT+ (37.5 %) followed by *S.* Infantis (18.6 %) and *S.* Typhimurium (16.2 %). The monophasic variant of *S.* Typhimurium was not submitted. Only two isolates (4.7 %) of *S.* Enteritidis were submitted (Fig. 8.1).

Of the isolates submitted, 70 % were resistant to at least one antimicrobial substance, the majority (63 %) to several substance classes (Fig. 8.7). The predominant resistances were to fluoroquinolones (51 %), trimethoprim, sulfamethoxazole, tetracycline and ampicillin (Fig. 8.8). All 16 isolates of the serovar *S.* Paratyphi B dT+ and six of the eight isolates of *S.* Infantis were multiresistant. These two serovars also showed the highest rate of resistance to fluoroquinolones (94 and 50 %), with 19 of the 22 ciprofloxacin resistant isolates belonging to this serovar. All isolates of *S.* Enteritidis were susceptible, but only one of the *S.* Typhimurium isolates showed a pentaresistance with the others being susceptible (Fig. 8.9).

Fig. 8.7: Resistance of selected serovars from pork, turkey meat and chicken meat to antimicrobial substances (zoonosis monitoring 2009). Number of classes of antimicrobials the isolates were resistant to

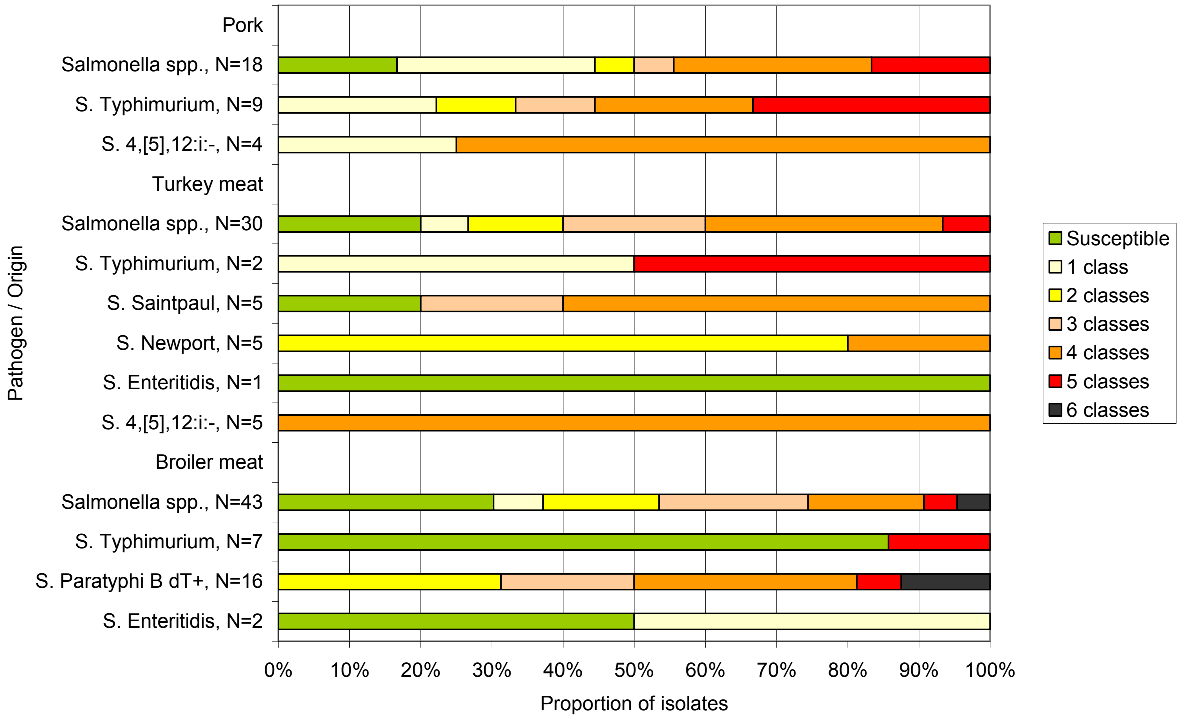


Fig. 8.8: Resistance of *Salmonella* isolates from chicken meat to antimicrobial substances (zoonosis monitoring 2009)

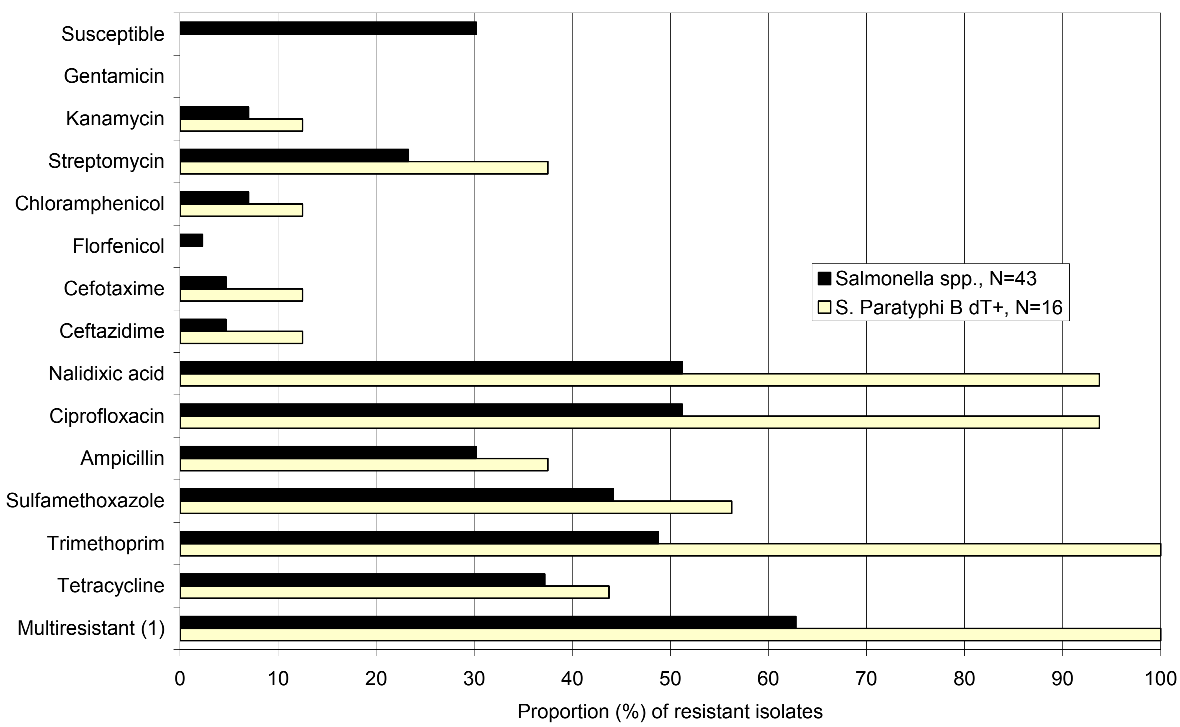
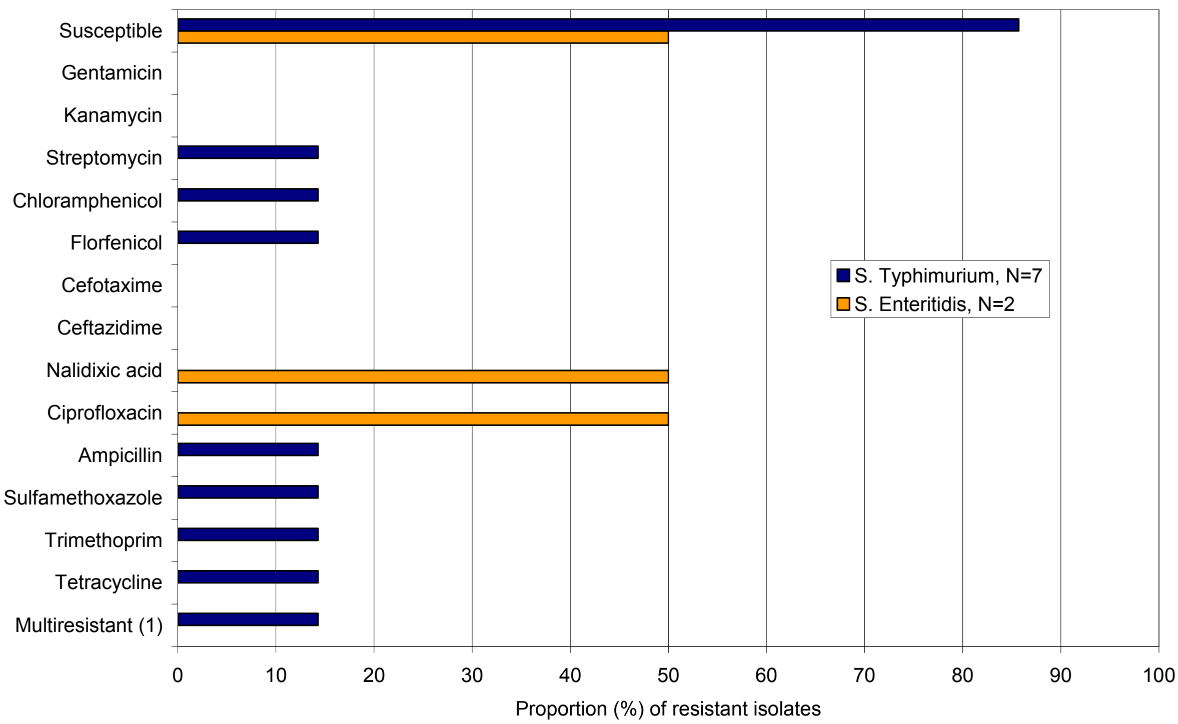


Fig. 8.9: Resistance of *Salmonella* isolates from chicken meat to antimicrobial substances (2009)



8.3.2 Turkey meat

No serovar was clearly predominant among the 30 isolates from turkey meat (Fig. 8.1). The serovars *S.* Saintpaul, *S.* Newport, and the monophasic variant of *S.* Typhimurium with five isolates each were equally frequently represented, followed by *S.* Bredeney (three isolates) and *S.* Typhimurium (two isolates). 80 % of the isolates were resistant, most of them (73 %) multiresistant (Fig. 8.10). The highest rates of resistance were recorded towards ampicillin and sulfamethoxazole, followed by the fluoroquinolones and streptomycin. One isolate was resistant to third generation cephalosporins.

Isolates of *S.* 4,[5],12:i:-, *S.* Newport (five isolates each) and *S.* Infantis (two isolates) were completely resistant. The highest resistance rates to ciprofloxacin were established with *S.* Saintpaul (60 %) and *S.* Infantis (50 %). Isolates of *S.* Senftenberg, *S.* Enteritidis (one) and *S.* Subspec. I rough were all susceptible.

8.3.3 Veal

Only one susceptible isolate of the serovar *S.* Dublin from veal was submitted.

8.3.4 Pork

Most of the 18 isolates from pork belonged either to the serovar *S.* Typhimurium (nine isolates) or its monophasic variant (four isolates) (Fig. 8.1). Two isolates belonged to the serovars *S.* Derby and *S.* Brandenburg, respectively, one to *S.* Infantis.

Most of the isolates were resistant (83 %) or even multiresistant (56 %). Only three isolates of *S.* Brandenburg and *S.* Infantis were susceptible. The predominant resistances were to tetracycline, sulfamethoxazole, ampicillin and streptomycin (Fig. 8.12). No resistances to fluoroquinolones or third generation cephalosporins were detected in isolates from pork.

Fig. 8.10: Resistance of *Salmonella* isolates from turkey meat to antimicrobial substances (2009)

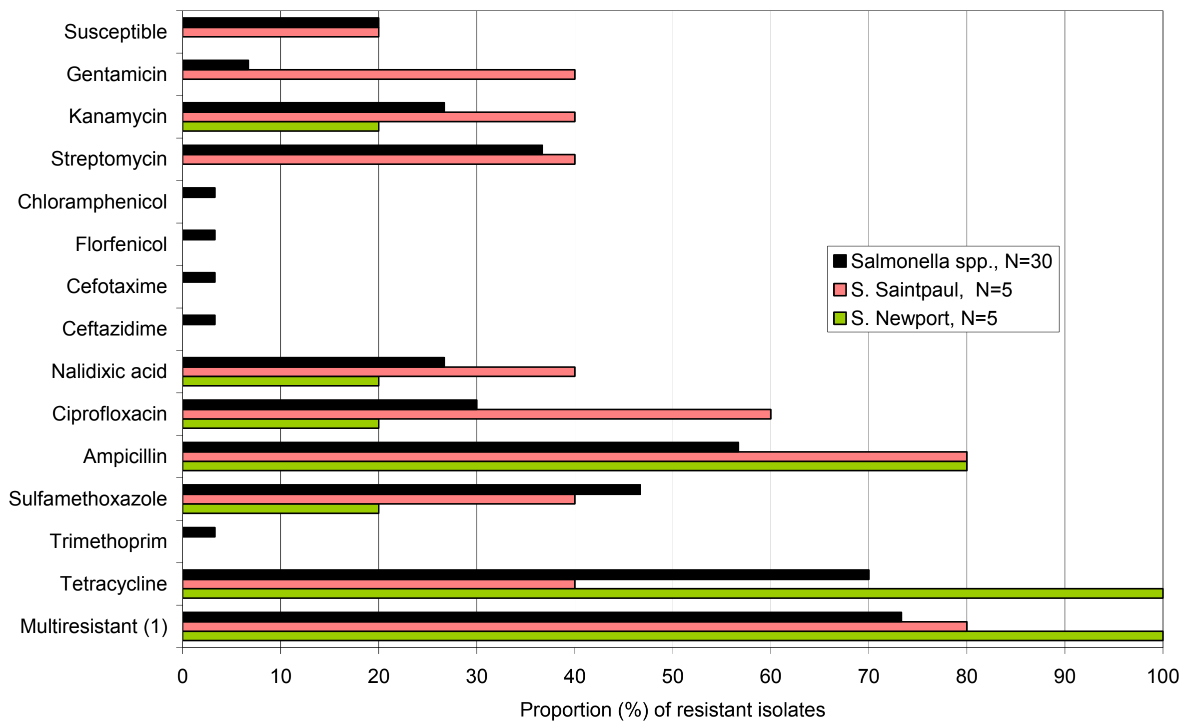


Fig. 8.11: Resistance of Salmonella isolates from turkey meat to antimicrobial substances (2009)

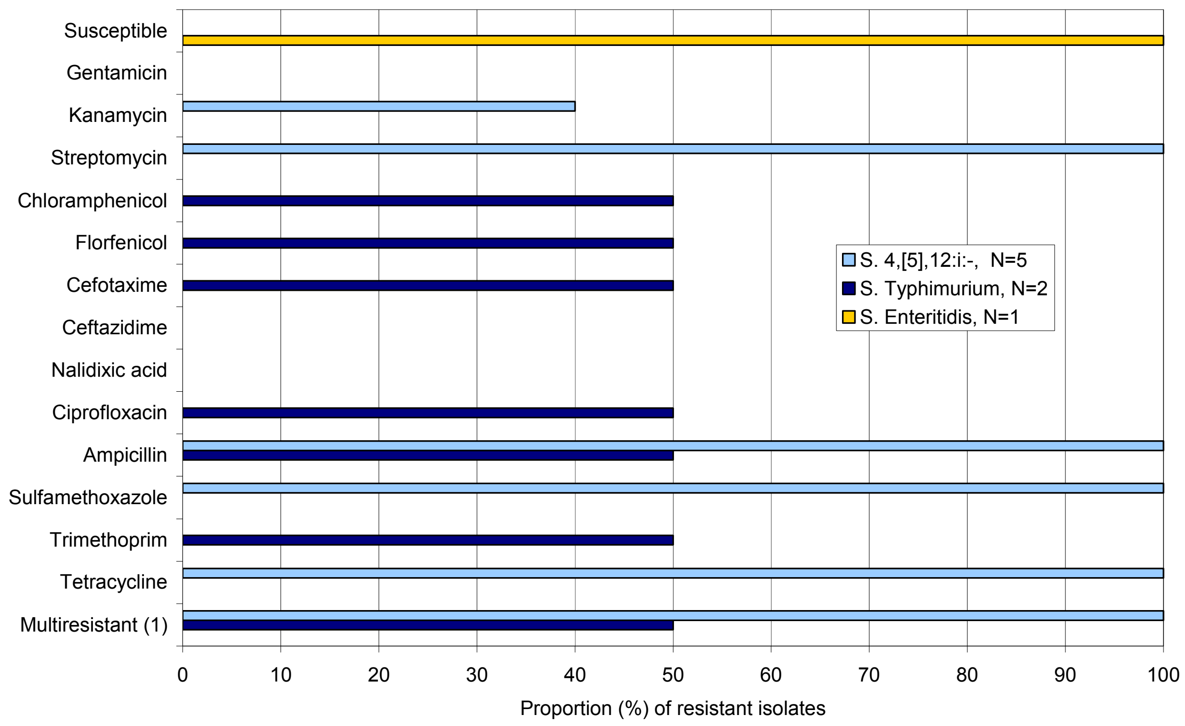
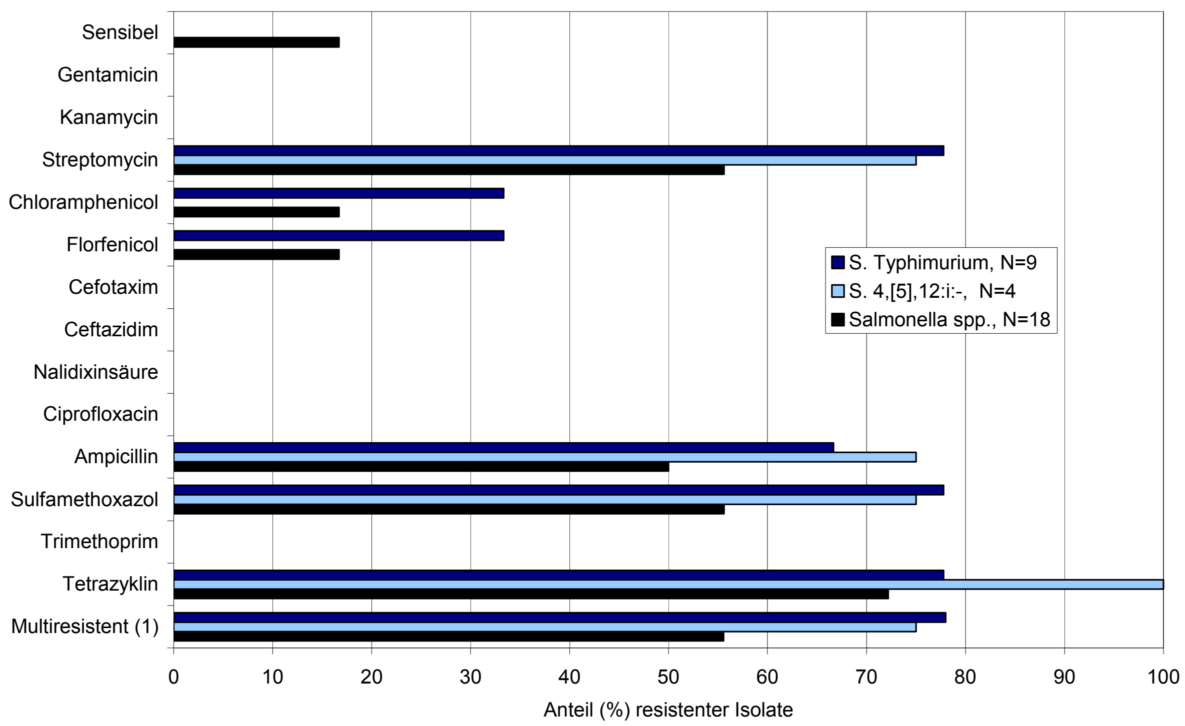


Fig. 8.12: Resistance of *Salmonella* isolates from pork to antimicrobial substances (2009)



8.4 Comparison of the resistance of isolates from animals and those originating from food produced from populations of the same animals

Within the scope of the monitoring in 2009, isolates from broiler flocks were compared with isolates from chicken meat. A high degree of conformity was revealed regarding both the percentage of serovars (Fig. 8.1) as well as their resistance to antimicrobial substances (Fig. 8.13). *S.* Paratyphi B dT+ was predominant in both origins with 40 and 35 % of the isolates, respectively. This serovar was often multiresistant in both origins and produced the great majority of ciprofloxacin-resistant isolates. The isolates from chicken meat tended to be resistant more frequently than those from the animals.

S. Enteritidis and *S*. Typhimurium were submitted less often from both origins. *S.* Enteritidis was susceptible in both cases.

Fig. 8.13: Resistance of *Salmonella* isolates from broiler flocks and from chicken meat to antimicrobial substances (2009)

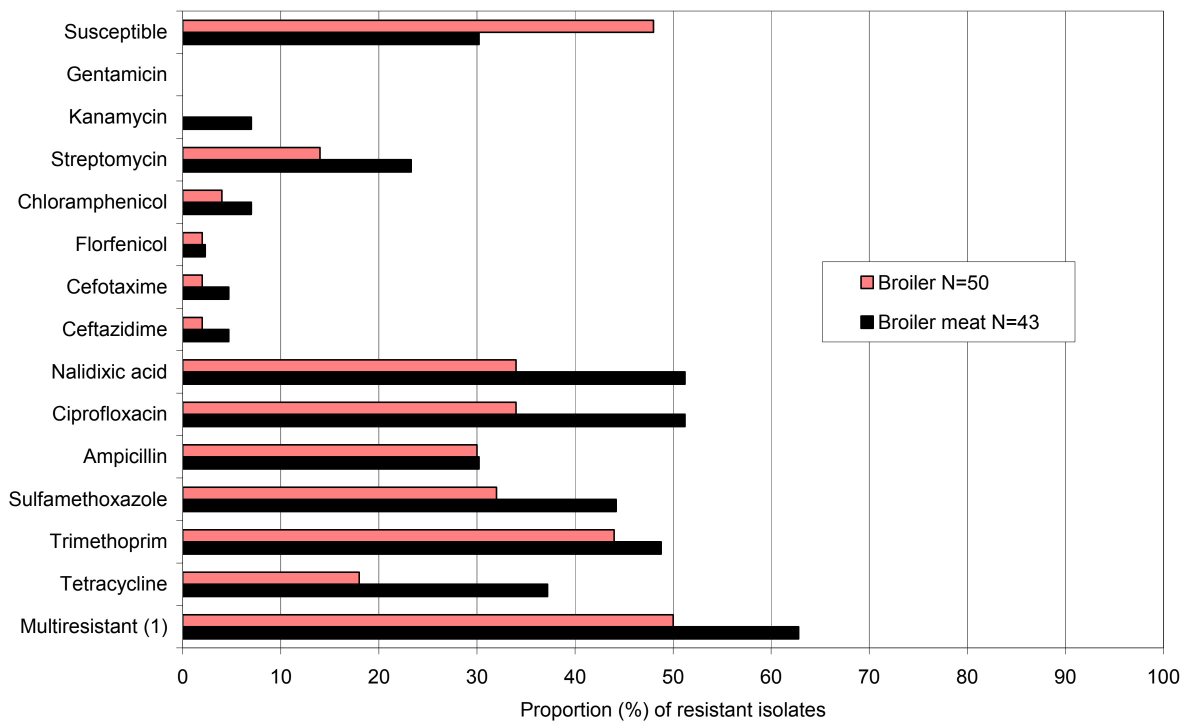
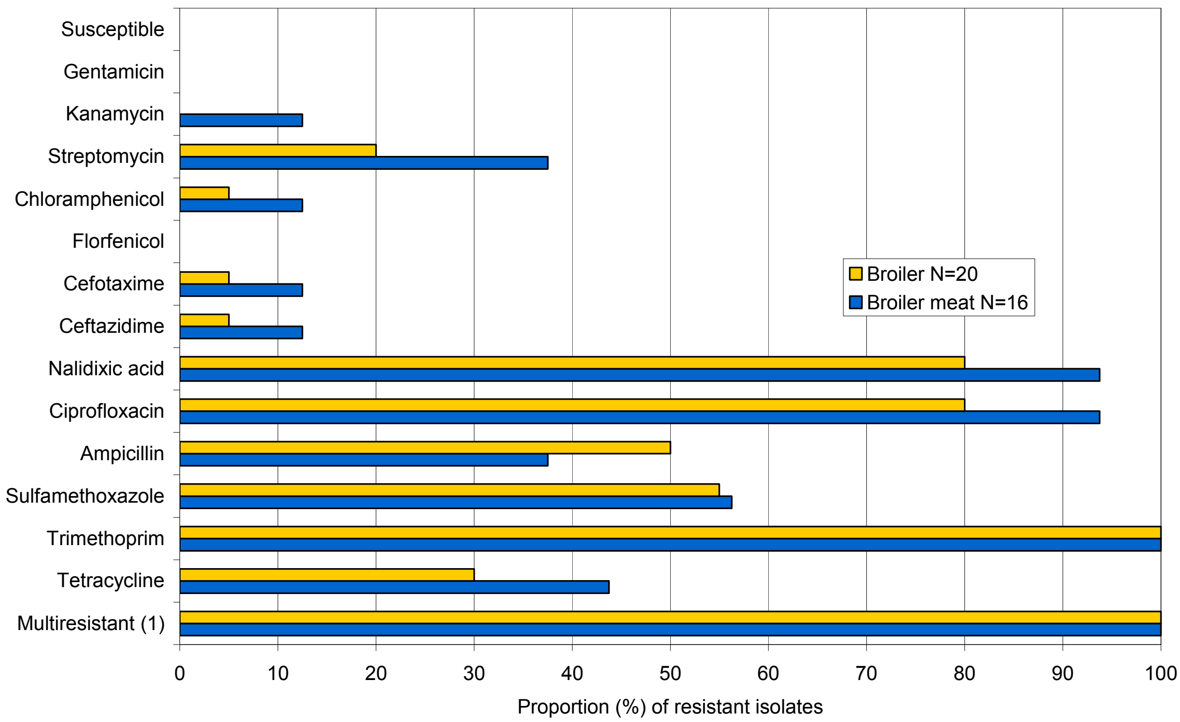


Fig. 8.14: Resistance of *S.* Paratyphi B dT+-isolates from broiler flocks and from chicken meat to antimicrobial substances (2009)



9 Description of the resistance situation in *Salmonella* spp. based on the data from various collection systems

9.1 Introduction

Investigations of the antimicrobial resistance of *Salmonella* from animals and food were conducted on the basis of diagnostic submissions and the isolates from zoonosis monitoring. Overall, the two data collection systems complement one another in a practicable manner so that a very precise picture of the resistance situation with *Salmonella* from the food chain is given in the collective observation of the results.

Data for 2009 on the species cattle, pigs, chicken and turkey, as well as the meat of these animals, was available. Within the scope of resistance monitoring, isolates from chickens (subdivided into laying hens and broilers) and the meat of broilers, turkey, pigs and veal calves was acquired (Tab. 9.1). The results of the various collection systems are compared in the following chapter. The individual chapters should be referred to for a detailed description.

Tab. 9.1: Number of isolates from the different origins and sampling procedures in 2009

Origin	Isolates from diagnostic submissions	Isolates from monitoring	Isolates total
Isolates from animals			
cattle	221	-	221
pig	343	0	343
chicken	315	266	581
laying hens	-	216	216
broiler	-	50	50
turkey	87	-	87
Isolates from food			
pork	148	18	166
beef	26	-	-
veal	-	1	1
meat from chicken	171	(43)*	214
broiler meat		43	43
turkey meat	78	30	108

* only isolates from broiler meat

9.2 Comparison of the results in the various food chains

9.2.1 Chicken

In the course of the control programmes, above all S. Enteritidis was submitted from laying hen flocks whereas *S.* Paratyphi B dT+ was submitted more often from broiler flocks and chicken meat. Within the scope of the diagnostics, *S.* Enteritidis was submitted most often from chicken without further specification of the intended use, but less often than isolates from the control programme for laying hens. *S.* Paratyphi B dT+ was seldom submitted from chicken within the scope of routine diagnostics but it was common in chicken meat. With chicken meat too, however, *S.* Paratyphi B dT+ was submitted less often in the course of diagnostics than in zoonosis monitoring.

The comparison of the serovars shows the importance of the precise specification of the origin of isolates in the transfer and processing of data.

With regard to resistance to antimicrobial substances, the isolates from diagnostics and monitoring only differed partly within the individual serovars. *S.* Enteritidis showed low resistance rates in both systems, whereas *S.* Paratyphi B dT+ was multiresistant almost without exception in both systems. *S.* Typhimurium from chicken was only 20 % resistant with isolates from diagnostics while most of the isolates from zoonosis monitoring were resistant. The latter finding also complies with the investigations of past years, which means that the low resistance rate from diagnostics should be interpreted with caution. A pentaresistance predominated with *S.* Typhimurium, unlike *S.* 4,[5],12:i,- with which quadruple resistance was detected most often. The difference lay in resistance to chloramphenicol which was not found in *S.* 4,[5],12:i,-.

9.2.2 Turkey

The data on isolates from turkey meat from the food chain turkey were compared between the two systems. Here too, there was a high degree of conformity with regard to the predominant serovars (*S.* Saintpaul and *S.* Typhimurium) and their resistance (mostly multiresistant).

9.2.3 Cattle/Calves

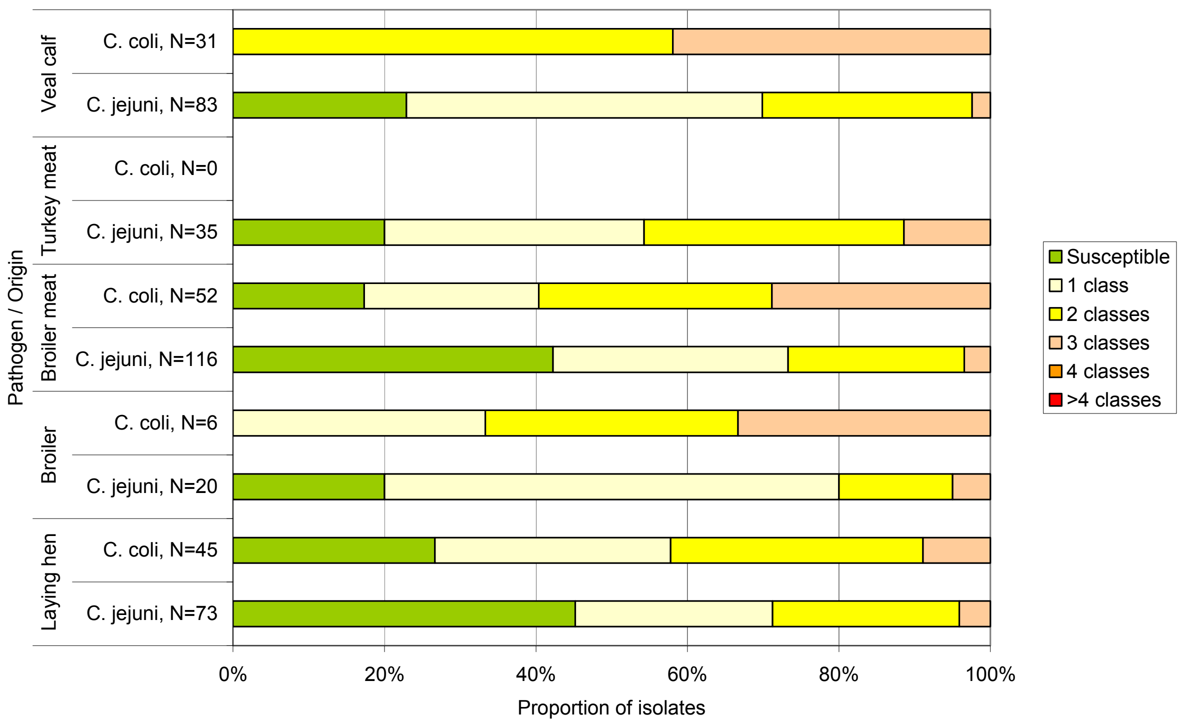
A direct comparison of the systems was not possible with veal because only “beef” was specified as an origin within the scope of diagnostics and because only a few isolates were submitted. Within the scope of zoonosis monitoring, only one isolate of *S.* Dublin was submitted. This isolate was susceptible, as were the four isolates of *S.* Dublin from beef submitted within the scope of diagnostics.

10 *Campylobacter* spp. from zoonosis monitoring 2009

Isolates of *Campylobacter* spp. were obtained in 2009 in the course of investigations in line with the zoonosis monitoring system. The isolates were tested for their resistance to five antimicrobial substance classes (aminoglycosides, phenicols, [fluoro]quinolones, macrolides and tetracycline).

A total of 464 *Campylobacter* isolates were tested, all of which could be allocated to one of the eight zoonosis monitoring programmes. They comprised 328 isolates of *C. jejuni* and 136 isolates of *C. coli*. The examination results were presented and evaluated separately for the two species. The vast majority of the isolates (*C. jejuni; C. coli)* came from laying hens, broilers and veal calves, as well as chicken meat and turkey meat (Fig. 10.1). Only single isolates were available from dairy cattle, veal and pork.

Fig. 10.1: Resistance of Campylobacter spp. from zoonosis monitoring to antimicrobial substances (2009). Number of classes of antimicrobials the isolates were resistant to

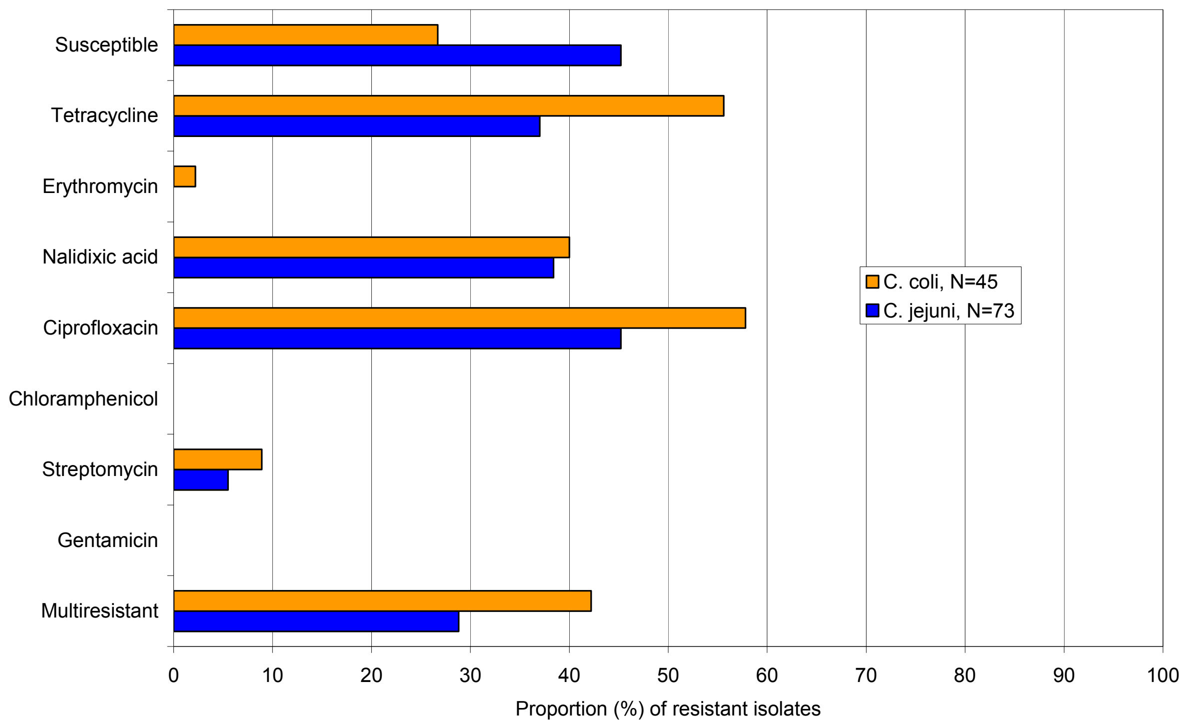


10.1 Isolates from animals

10.1.1 Laying hens

A total of 118 isolates from laying hens were investigated, of which 73 could be categorised to the species *C. jejuni* and 45 to the species *C. coli*. Of the investigated isolates, 61.9 % were resistant, 33.9 % to more than one antimicrobial substance class. The resistance rates of *C. coli* were all higher than those of *C. jejuni*, with particularly high rates of resistance to tetracycline and ciprofloxacin (Fig. 10.2). No resistance to chloramphenicol and gentamicin was detected. Only one isolated of *C. coli* was resistant to erythromycin.

Fig. 10.2: Resistance of *Campylobacter* isolates from laying hens to antimicrobial substances (2009)



10.1.2 Broilers

A total of 26 isolates from broilers were investigated, of which 20 could be assigned to the species *C. jejuni* and six to the species *C. coli*. Of the investigated isolates, 61.9 % were resistant, 33.9 % to more than one antimicrobial substance class. The resistance rates in *C. coli* were all higher than in *C. jejuni*, with particularly high rates of resistance to tetracycline and ciprofloxacin (Fig. 10.3). No resistance to chloramphenicol and gentamicin was detected. One isolate each of *C. coli* and *C. jejuni* was resistant to erythromycin.

10.1.3 Veal calves

A total of 114 isolates from veal calves were investigated, of which 83 could be categorised to the species *C. jejuni* and 31 to the species *C. coli*. Of the investigated isolates, 61.9 % were resistant, 33.9 % to more than one antimicrobial substance class. The resistance rates with *C. coli* were all higher than with *C. jejuni*, with particularly high rates of resistance to tetracycline and ciprofloxacin (Fig. 10.4). No resistance to chloramphenicol, gentamicin and erythromycin was detected.

Fig. 10.3: Resistance of *Campylobacter* isolates from broilers to antimicrobial substances (2009)

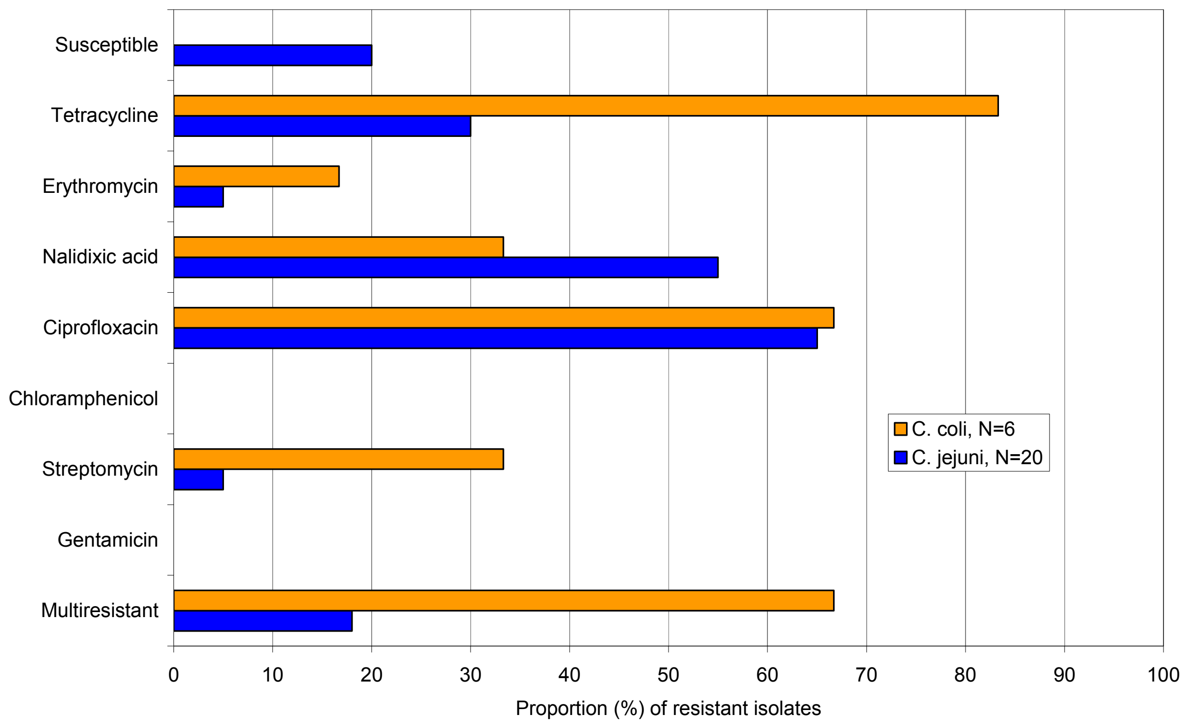
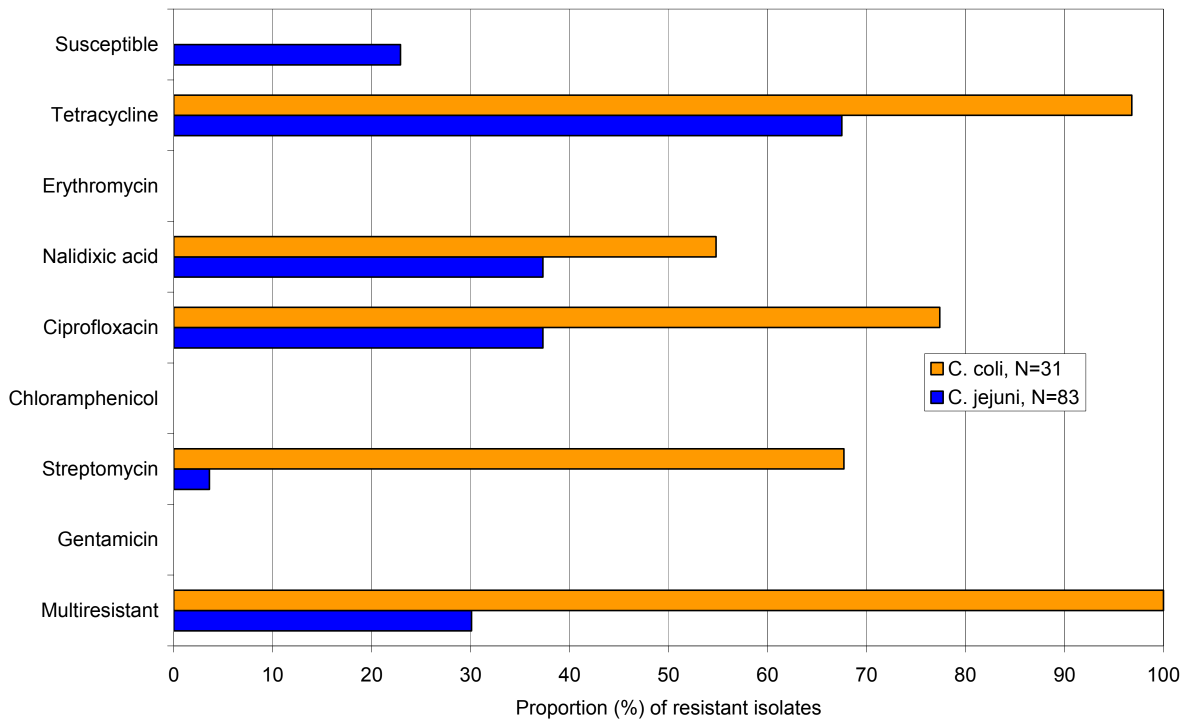


Fig. 10.4: Resistance of *Campylobacter* isolates from veal calves at the abattoir to antimicrobial substances (2009)



10.2 Isolates from food

10.2.1 Broiler meat

A total of 168 isolates from broiler meat were investigated, of which 116 could be categorised to the species *C. jejuni* and 52 to the species *C. coli*. Of the investigated isolates, 65.5 % were resistant, 26 % to more than one antimicrobial substance class. The resistance rates in *C. coli* were significantly higher in chicken meat too than in *C. jejuni*, with particularly high rates of resistance to tetracycline and ciprofloxacin (Fig. 10.3). No resistance to chloramphenicol and gentamicin were detected. Eight isolates of *C. coli* (15.4%) were resistant to erythromycin.

10.2.2 Turkey meat

A total of 35 isolates from turkey meat were investigated, all of which were categorised to the species *C. jejuni*. Of the investigated isolates, 80.0 % were resistant, 45.7 % to more than one antimicrobial substance class. Particularly high rates of resistance to tetracycline and ciprofloxacin were also observed in *C. jejuni* from turkey meat (Fig. 10.6). No resistance to chloramphenicol and gentamicin was detected. One isolate of *C. jejuni* (15.4%) was resistant to erythromycin.

10.2.3 Other meat

Only three isolates from veal and pork were available for resistance testing. One susceptible *C. jejuni* isolate from veal was tested, whereas one *C. coli* isolate was resistant to tetracycline, streptomycin, nalidixic acid and ciprofloxacin. The *C. coli* isolate from pork was resistant to tetracycline and erythromycin. One isolate from milk was completely susceptible.

Fig. 10.5: Resistance of *Campylobacter* isolates from broiler meat at retail to antimicrobial substances (2009)

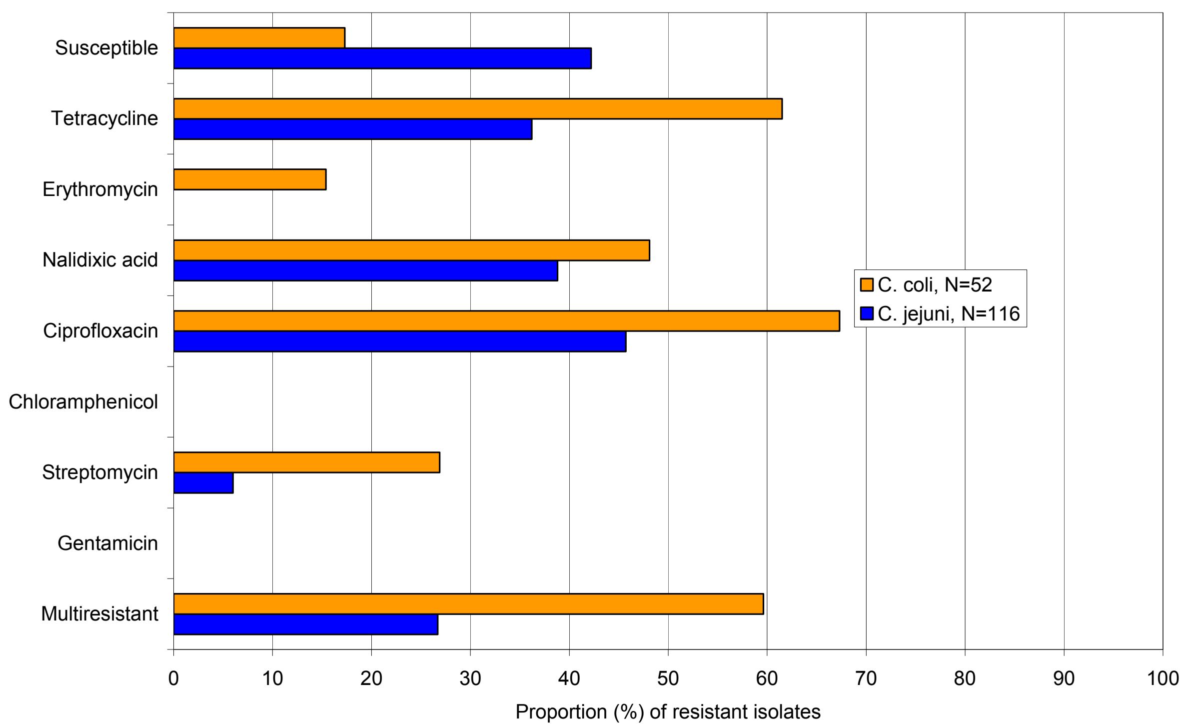
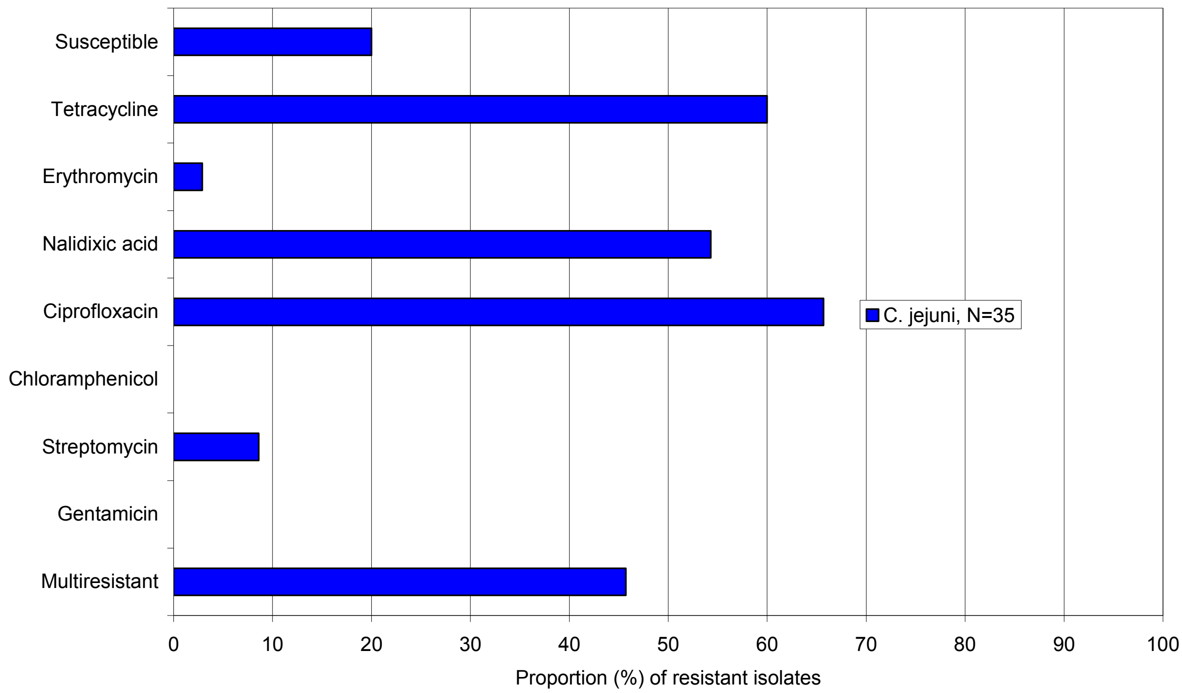


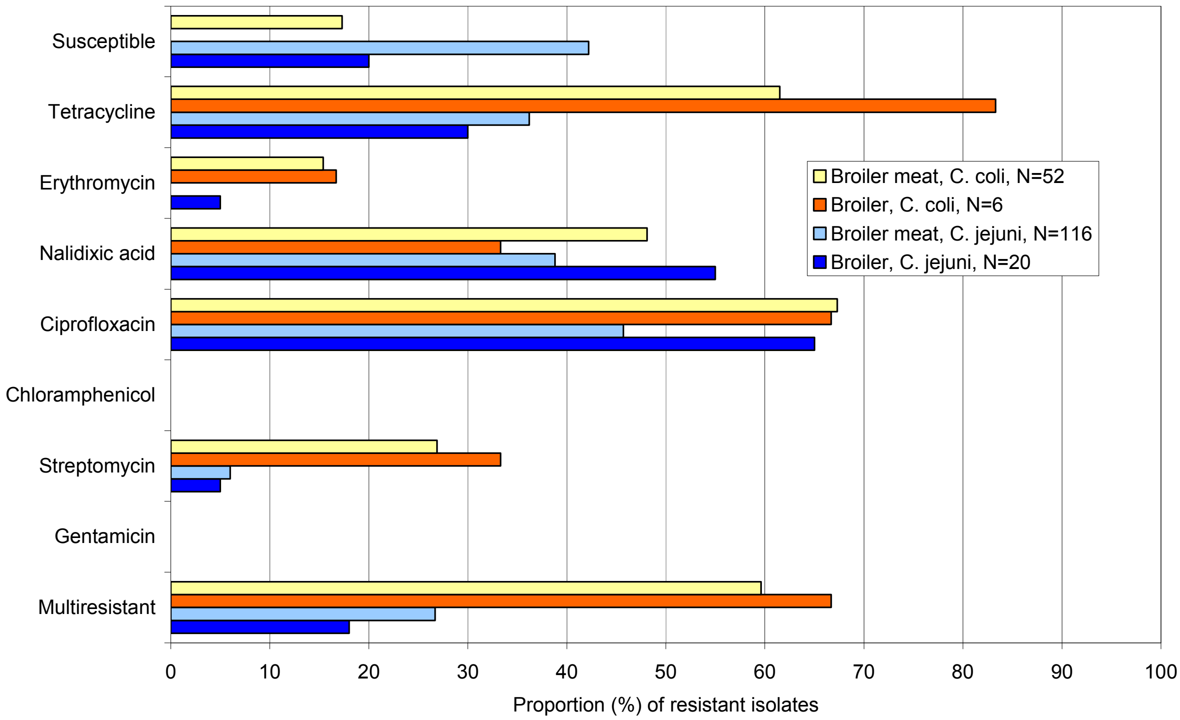
Fig. 10.6: Resistance of *Campylobacter* isolates from turkey meat at retail to antimicrobial substances (No isolates of *C. coli* were submitted) (2009)



10.3 Comparison of isolates from animals and those from food derived from them

A comparison of the isolates from livestock and from food was only possible for the food chain broiler meat. It was shown here that overall, more isolates from animals were resistant and that the rates of multiresistant isolates from broilers and chicken meat were relatively similar (Fig. 10.7). The results regarding the pathogen-active substance combinations were heterogeneous. It should be taken into account, however, that a total of only 26 isolates from animals were investigated, of which only six were categorised to *C. coli* so that the differences between the origins should be evaluated with caution with *C. coli* in particular.

Fig. 10.7: Comparison of resistance of *Campylobacter* isolates from broiler flocks and broiler meat at retail to antimicrobial substances (2009)



11 *Escherichia coli* as commensals from zoonosis monitoring 2009

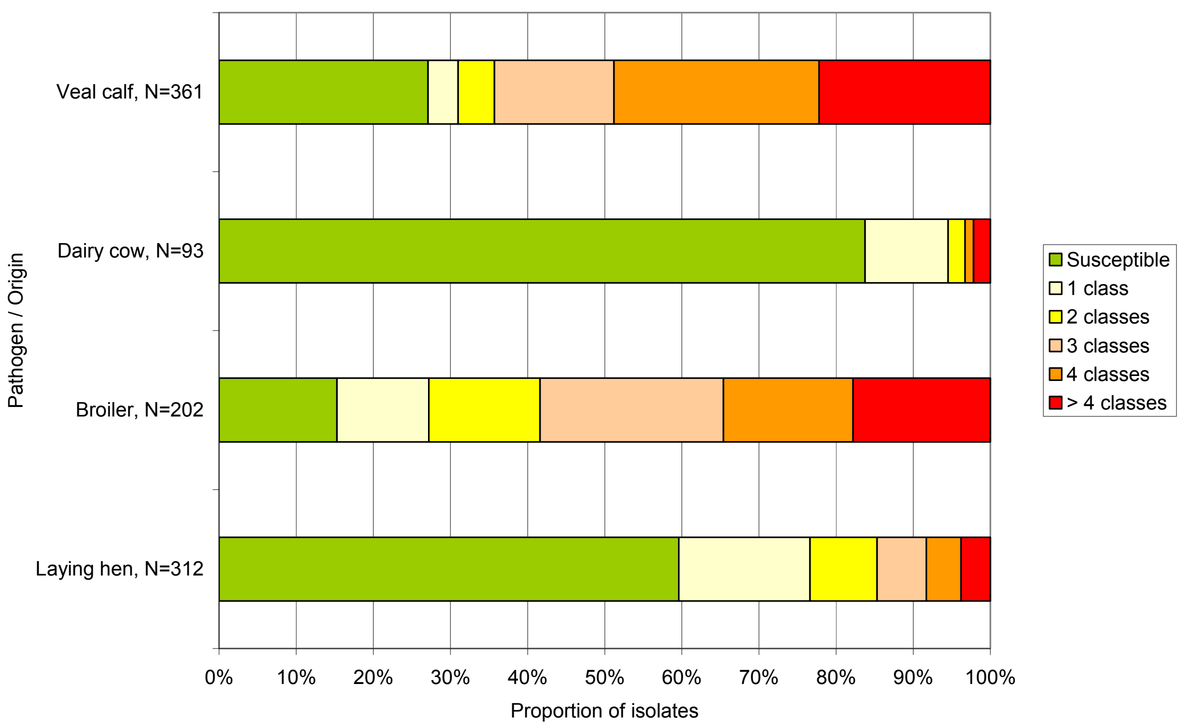
Isolates from commensal *Escherichia coli* were obtained in accordance with the General Administrative Regulation Zoonoses in the Food Chain (AVV Zoonosen Lebensmittelkette) within the scope of zoonosis monitoring in 2009. Isolates were obtained from livestock herds, as well as from abattoirs and food at retail.

11.1 Isolates from animals

Overall, isolates were obtained in four programmes, which are representative of livestock populations: faecal samples from laying hen and broiler flocks, bulk tank milk in dairy cattle farms and the colon content of veal calves at the abattoir. Fig. 11.1 shows the proportion of susceptible isolates along with those among the four populations which are resistant to a varying number of active substances. A distinct contrast can be recognised between the isolates from laying hens and dairy cows on the one hand and those of broilers and veal calves on the other. Whereas most of the isolates from laying hens and dairy cows were susceptible, (59.6 and 83.9 % respectively) and the proportion of multiresistant isolates was relatively low (23.4 and 5.5 %), most of the isolates from broilers and veal calves were multiresistant (72.8 and 69.0 %) and only a few susceptible (15.3 and 27.1 %).

Of the resistant isolates, four showed a resistance to all seven antimicrobial substance classes. Three of these were from veal calves and one from laying hens. Apart from this, resistance to three to five substance classes was predominant in veal calves and broilers while the resistant isolates from laying hens and dairy cattle were mostly only resistant to one or two substance classes.

Fig. 11.1: Resistance of commensal *E. coli* from veal calves, dairy cows, broilers and laying hens (zoonosis monitoring 2009). Number of classes of antimicrobials the isolates were resistant to



11.1.1 Laying hens

Isolates from laying hens were resistant to roughly 40 % with resistances to ampicillin, sulfamethoxazole and tetracycline being the most common (18–25 %), followed by resistance to kanamycin, trimethoprim, streptomycin and the quinolones nalidixic acid and ciprofloxacin (8–12 %) (Fig. 11.2). With < 3 %, resistance to gentamicin, florfenicol and the third generation cephalosporins tended to be rare.

11.1.2 Broilers

Isolates from broilers were resistant to 84.7 %, mostly (72.8%) to more than one substance class (Fig. 11.2). The highest rates of resistance were observed towards ampicillin and sulfamethoxazole (65 % each), followed by trimethoprim (48%) and streptomycin, the quinolones (41–43 %) and tetracycline (36 %). Of the investigated species, isolates from broilers showed the highest rate of resistance to third generation cephalosporins (5.4 % and 5.9 % respectively).

11.1.3 Dairy cattle

Dairy cattle carried the lowest percentages of resistant (16.1 %) and multiresistant (5.5 %) isolates among the livestock species investigated in 2009 (Fig. 11.3). The highest resistance rate was observed towards sulfamethoxazole (11.8 %), while resistance to all other substances was only observed in less than 5 % of the isolates. All isolates were susceptible to third generation cephalosporins and two (2.2 %) were resistant to ciprofloxacin.

11.1.4 Veal calves

Compared to dairy cattle, veal calves showed considerably more resistant (72.9 %) and multiresistant commensal *E. coli* (69.0 %) (Fig. 11.3). The highest rates of resistance were recorded here towards tetracycline, sulfamethoxazole, ampicillin, trimethoprim and streptomycin (52 to 66 %). 13.3 % of the isolates were resistant to ciprofloxacin and 3 % to third generation cephalosporins.

Fig. 11.2: Resistance of isolates of commensal *E. coli* from laying hens and broilers to antimicrobial substances (2009)

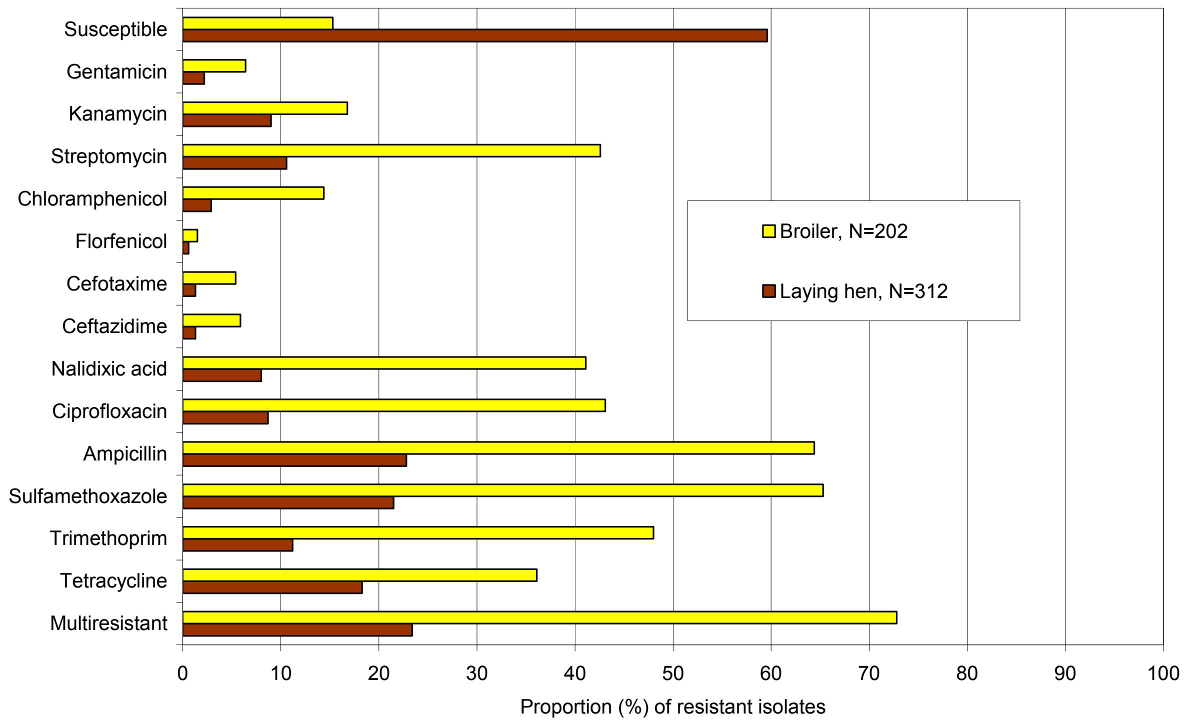
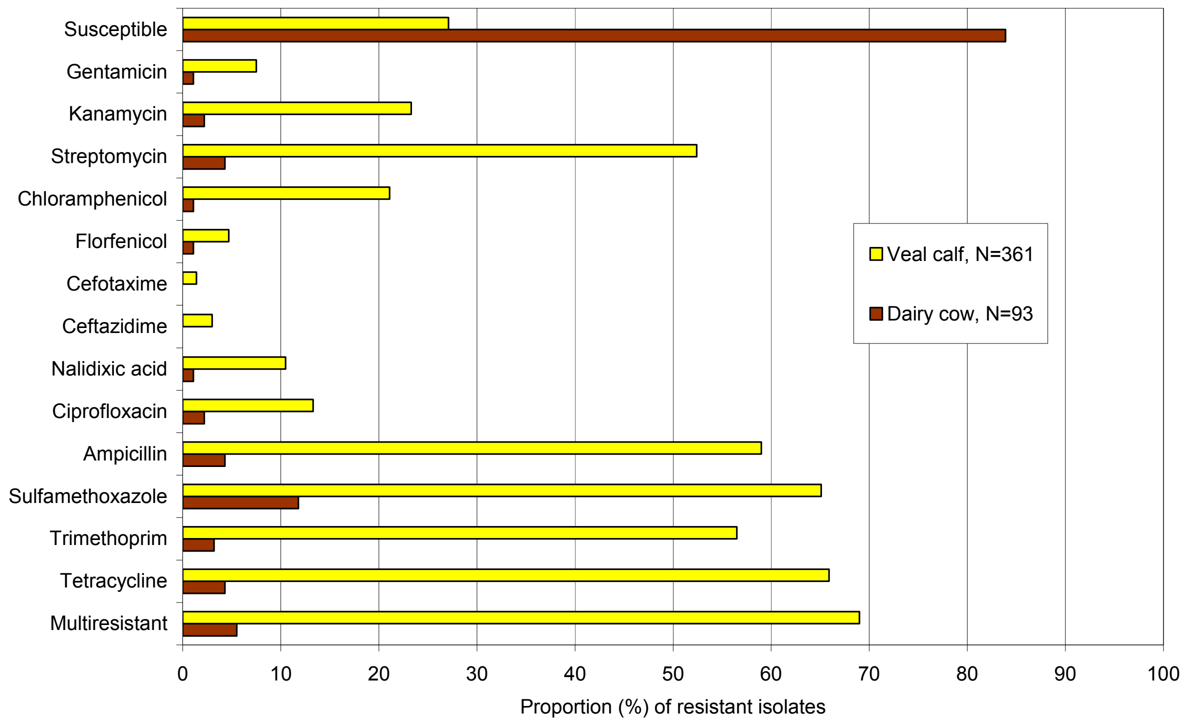


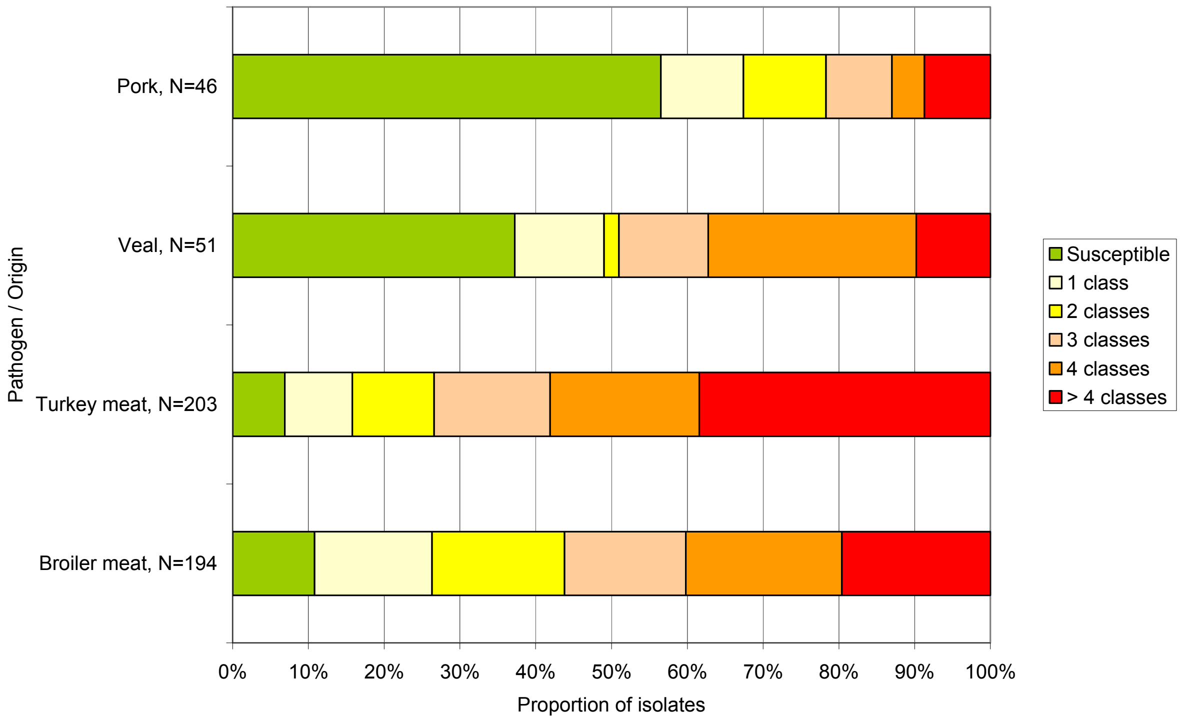
Fig. 11.3: Resistance of isolates of commensal *E. coli* from dairy cows and calves to antimicrobial substances (2009)



11.2 Isolates from food

Within the scope of zoonosis monitoring in 2009, the meat of pigs, calves, turkeys and chickens was examined for commensal *E. coli* and the isolates submitted to the BfR for resistance testing. Of the isolates submitted, poultry meat showed a higher proportion of resistant and multiresistant isolates than veal and pork (Fig. 11.4).

Fig. 11.4: Resistant commensal *E. coli* from pork, veal, turkey meat and broiler meat (zoonosis monitoring 2009). Number of classes of antimicrobials the isolates were resistant to



11.2.1 Broiler meat

Almost 90 % of the *E. coli* isolates from broiler meat were resistant to at least one class of antimicrobial substances and 73.7 % to several classes, whereby one isolate was resistant to all seven classes investigated.

Resistance to sulfamethoxazole (61.3 %) and ampicillin (59.3 %) was particularly common, followed by ciprofloxacin (53.1 %) (Fig. 11.5). The latter is particularly problematic because fluoroquinolones, are among the critically important antimicrobials in human medicine according to WHO. Isolates from broiler meat also showed the highest resistance rates of all investigated meat categories (6.2 %) towards third generation cephalosporins. Other substances to which resistance was frequently observed were trimethoprim, tetracycline and streptomycin (40–50 %). The lowest rates of resistance were detected towards florfenicol (1.5 %).

11.2.2 Turkey meat

Overall, the proportion of resistant and multiresistant isolates in turkey meat was slightly higher than in chicken meat (93.1 as opposed to 84.2 %). The biggest difference was observed in regard to tetracycline, where 82.8 % of turkey meat isolates were resistant compared to 45.4 % in broiler meat. The resistance rate in turkey meat isolates was also significantly higher than in those from broiler meat isolates for ampicillin, sulfamethoxazole, streptomycin and chloramphenicol. In contrast, the proportion of isolates that were resistant to the substance classes, which are of particular importance for human medicine, was lower (Fig. 11.5). With a proportion of 30 %, however, the resistance rate towards the fluoroquinolone ciprofloxacin was also very high in turkey meat. Only two isolates (1.0 %) were resistant to third generation cephalosporins.

11.2.3 Veal

The majority of isolates from veal were also resistant to at least one substance (62.7 %; Fig. 11.6), but often to several substance classes (50.9 %). Isolates resistant to tetracycline and sulfamethoxazole were predominant in veal (53 and 51% respectively). Resistances to ampicillin, streptomycin and trimethoprim (35–41 %) were also observed frequently. Resistances to fluoroquinolones were not as common (3.9 %) as in poultry meat and no resistance to third generation cephalosporins was observed.

11.2.4 Pork

Almost half of the 46 isolates from pork (43.5 %) were resistant to one substance class and roughly a third (32.6 %) to more than one class (Fig. 11.6). The predominant resistances were towards streptomycin and tetracycline (32.6 and 28.3 % respectively). More than 20 % of the isolates were also resistant to ampicillin and sulfamethoxazole. Resistances to gentamicin, florfenicol and third generation cephalosporins were only rarely observed (one isolate each, 2.2 %). Three isolates (6.5 %) were resistant to the tested (fluoro)quinolones.

Fig. 11.5: Resistance of isolates of commensal *E. coli* from turkey meat and chicken meat to antimicrobial substances (2009)

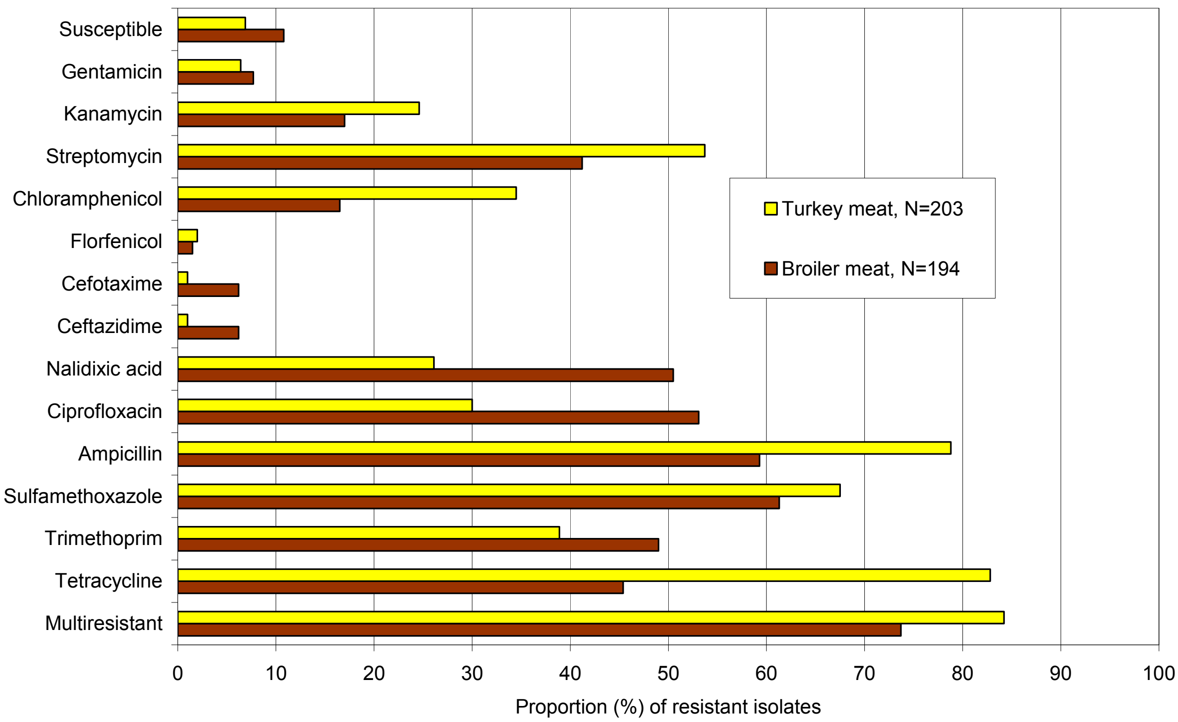
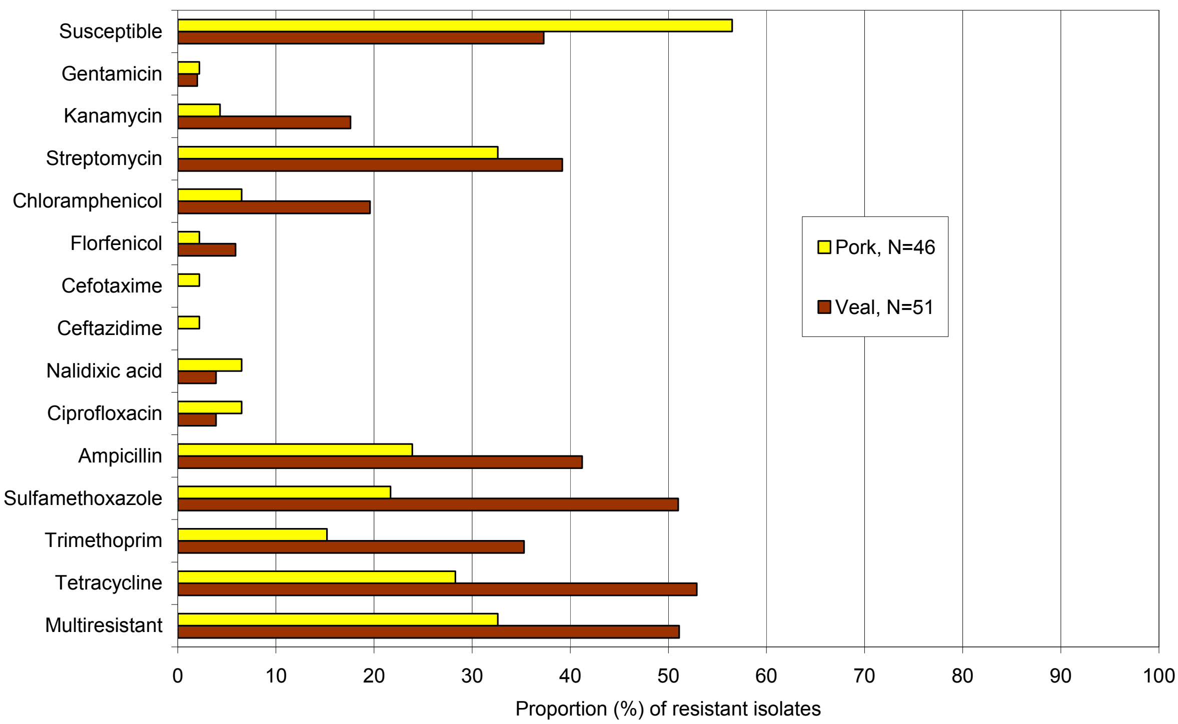


Fig. 11.6: Resistance of isolates of commensal *E. coli* from pork and veal to antimicrobial substances (2009)



11.3 Comparison of the resistance of *E. coli* isolates from animals with those of food originating from the same population

A comparison of *E. coli* isolates from animals and food was possible within the scope of the monitoring conducted in 2009 for the populations of broilers and veal calves. It is remarkable that from a comparable number of samples, considerably more isolates from broiler meat were submitted, whereas commensal *E. coli* was isolated less often from veal.

11.3.1 Broilers and broiler meat

The resistance rates with isolates from broilers and broiler meat matched up largely where the frequency of total resistances was concerned, as well as resistance to the various antimicrobial substances (Fig. 11.7). This is of importance in particular due to the relatively high rates of resistance to the antimicrobials, which are critically important for human medicine (fluoroquinolones and third generation cephalosporins). The conformance is indicative of a transfer of the resistant bacteria from the animal to the carcass and on to the meat within the scope of meat production and processing. This observation has been well documented in the past for *Salmonella*. Due to the high level of agreement of the resistance patterns, it appears necessary to work towards a reduction of the resistance rates in primary production, as well as the transfer rate during the slaughter process by means of further optimisation of slaughtering hygiene.

11.3.2 Veal calves and veal

As in the food chain broiler meat, the *E. coli* isolates from veal also showed a resistance pattern similar to that of veal calf isolates (Fig. 11.8). The proportion of resistant isolates in the meat was consistently lower, however, (with the exception of florfenicol) than it was in the isolates obtained from colon content at the abattoir. This also applied to the particularly important antimicrobial substances fluoroquinolones and cephalosporins. No cephalosporin-resistant isolates were detected in veal.

Here too, the similarity of the resistance patterns suggests the transfer of bacteria along the food chain. The differences in the levels of resistance rates could possibly be attributable to the cross-contamination of the meat with *E. coli* of another origin, but more thorough investigations would have to be made to confirm this hypothesis.

Fig. 11.7: Resistance of isolates of commensal *E. coli* from broilers and from broiler meat to antimicrobial substances (2009)

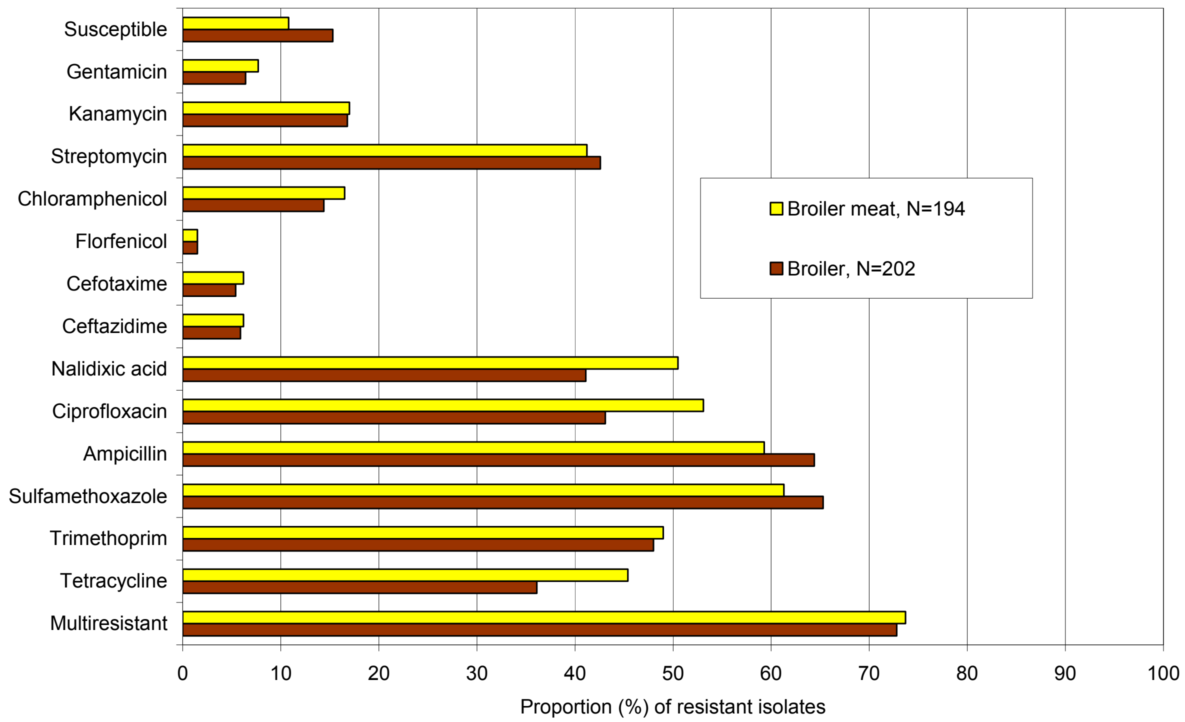
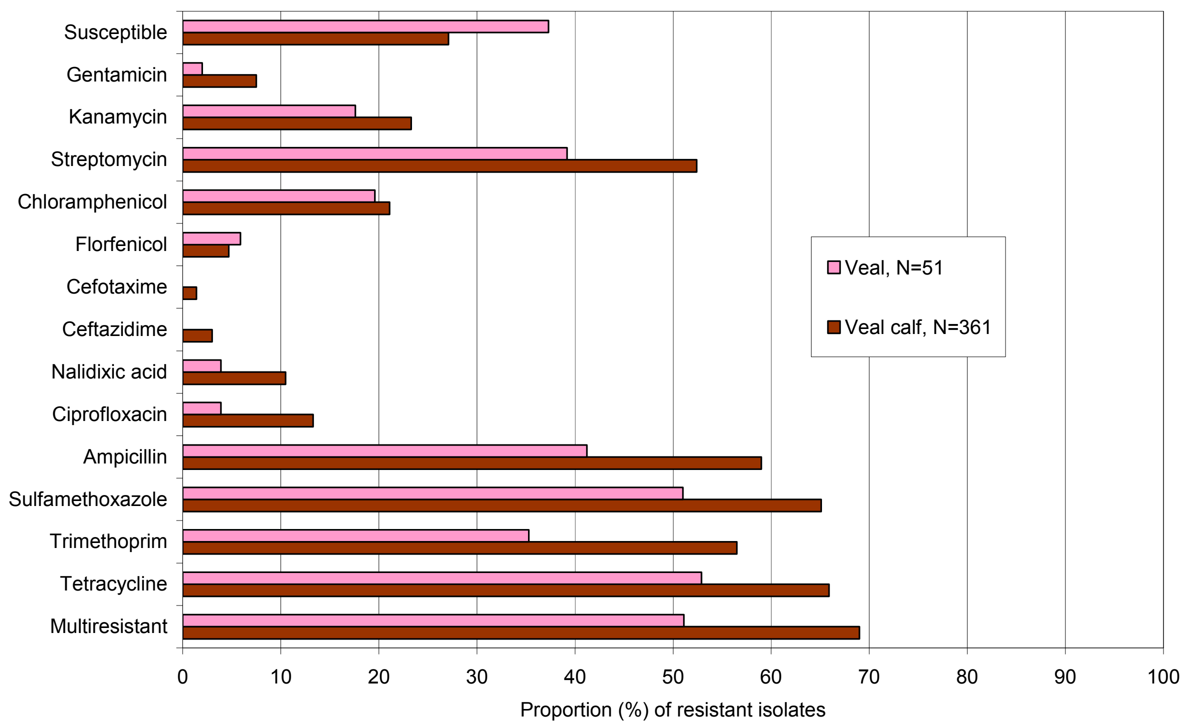


Fig. 11.8: Resistance of isolates of commensal *E. coli* from veal calves and veal to antimicrobial substances (2009)



12 Verotoxin-forming *Escherichia coli* (VTEC) from zoonosis monitoring 2009

Verotoxin-forming *Escherichia coli* (VTEC) were submitted from four origins within the scope of zoonosis monitoring: dairy cattle, veal calves, pork and veal. With only seven, the number of isolates from the bulk tank milk of dairy cows was low. The resistance rates of the isolates of different origins differed considerably. Whereas none of the isolates from tank milk was resistant, roughly half of the isolates of veal calves and veal showed resistance to one or more substances.

12.1 Isolates from animals

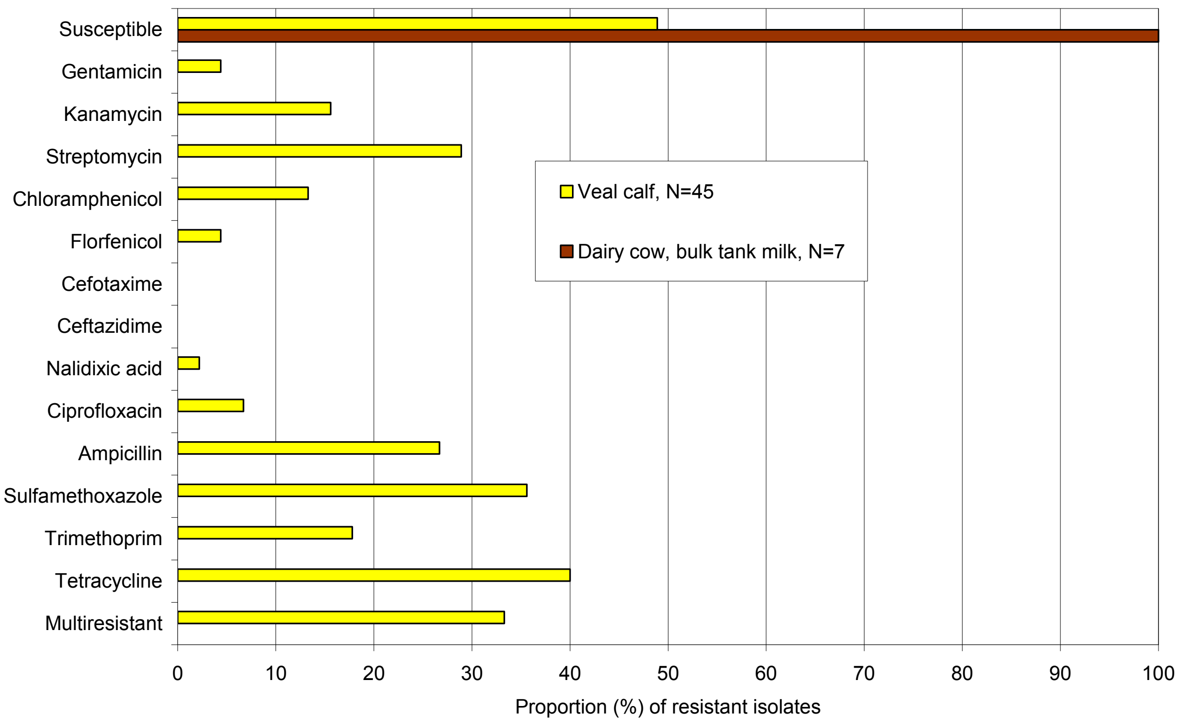
12.1.1 Veal calves

Of the 45 submitted isolates of verotoxin-forming *E. coli* from veal calves (Fig. 12.1), half were resistant (51.1 %) and a third multiresistant (32.3 %). The highest resistance rates were shown towards tetracycline (40 %) and sulfamethoxazole (35.6 %), followed by streptomycin (28.9 %) and ampicillin (26.7 %). No resistance to third generation cephalosporins was detected in VTEC from calves. Resistance to ciprofloxacin was detected in three isolates (6.7 %).

12.1.2 Dairy cattle

All seven VTEC isolates from the tank milk of dairy cows were susceptible (Fig. 12.1).

Fig. 12.1: Resistance of isolates of verotoxin-forming *E. coli* from dairy cows (bulk tank milk) and from veal calves to antimicrobial substances (2009)



12.2 Isolates from food

A total of 29 isolates from retail veal and pork were submitted.

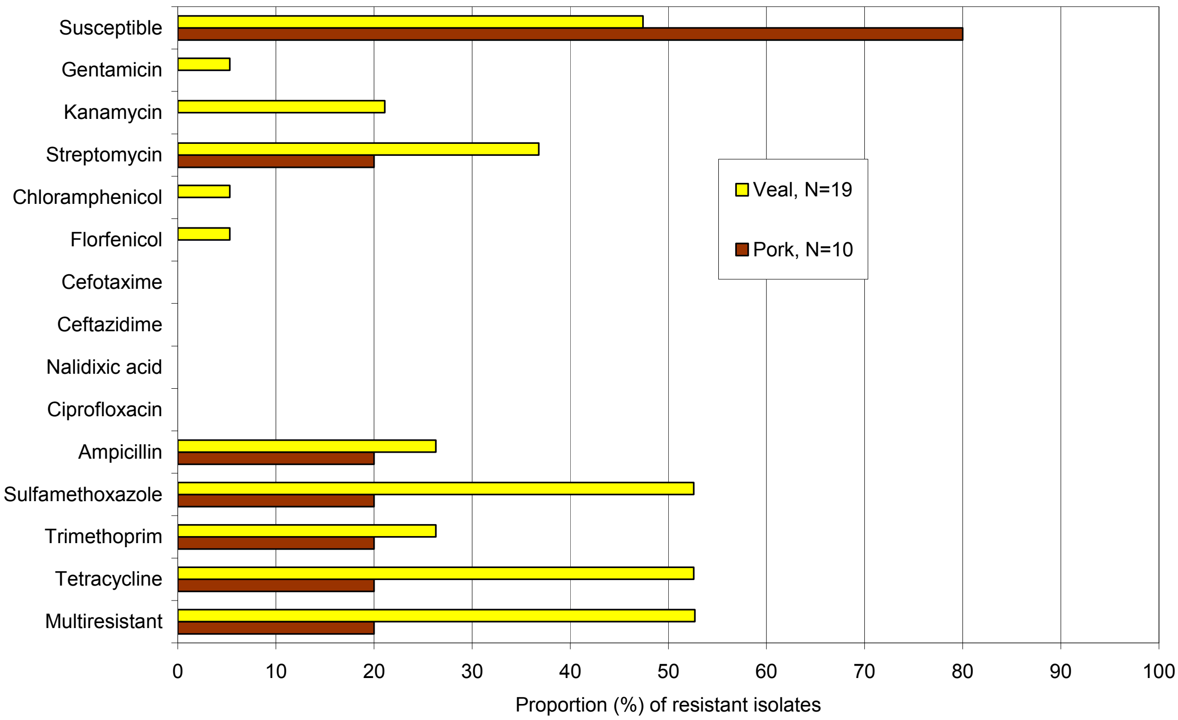
12.2.1 Veal

Of the 19 isolates submitted, roughly half were resistant (52.6 %) and also multiresistant (no single resistance, Fig. 12.2). The highest resistance rates were recorded for sulfamethoxazole and tetracycline (52.6 % respectively), followed by streptomycin (36.8 %), trimethoprim and ampicillin (26.3 % each). No resistances to the critically important antimicrobials (third generation cephalosporines, fluoroquinolones) were observed with isolates from veal.

12.2.2 Pork

Only ten isolates from pork were available (Fig. 12.2), two of which were resistant to streptomycin, ampicillin, sulfamethoxazole, trimethoprim and tetracycline. The other eight were susceptible to all substances.

Fig. 12.2: Resistance of isolates of verotoxin-forming *E. coli* from veal and pork to antimicrobial substances (2009)



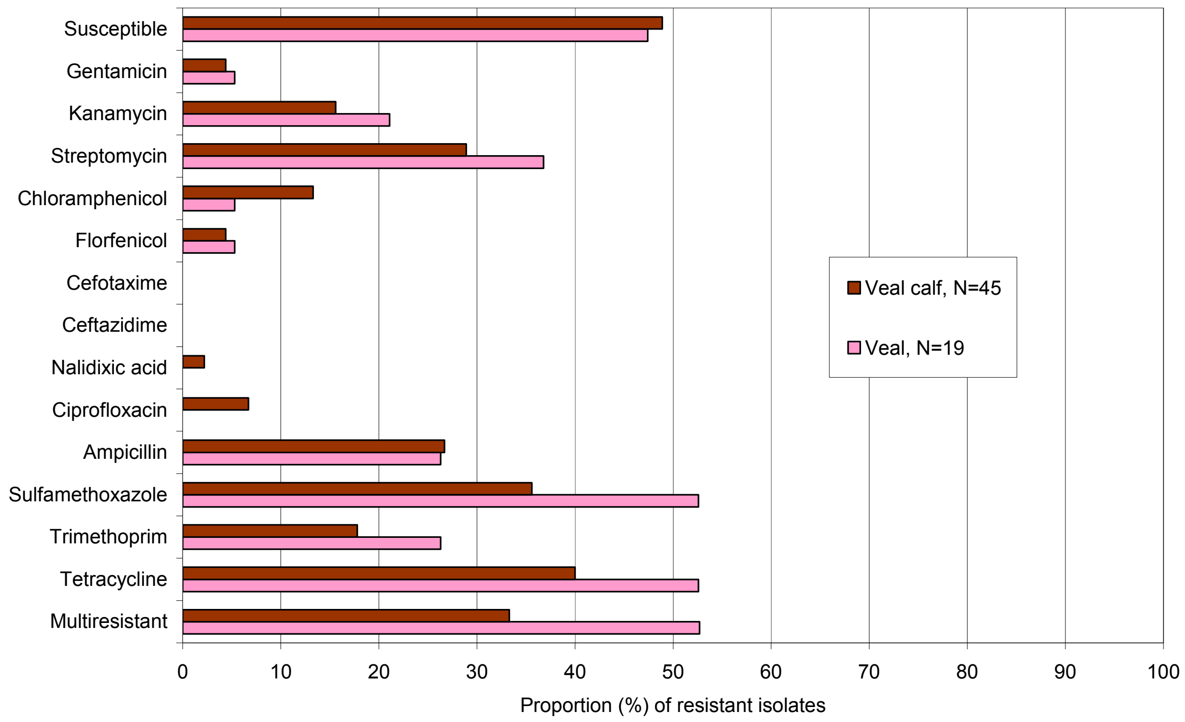
12.3 Comparison of the resistance of isolates from animals with those of food originating from the same population

All along the food chain, the VTEC isolates from veal calves could be compared with those from veal.

12.3.1 Veal calves and veal

Isolates from veal calves and veal showed similar resistance patterns (Fig. 12.3). Due to the limited number of isolates, the existing differences should not be overestimated.

Fig. 12.3: Resistance of isolates of verotoxin-forming *E. coli* from veal calves and from veal to antimicrobial substances (2009)



13 Methicillin-resistant *Staphylococcus aureus* (MRSA) from zoonosis monitoring 2009

13.1 Origin of isolates

In 2009, a total of 946 MRSA isolates which could be allocated to one of the nine national zoonosis monitoring programmes established for this purpose were tested for their resistance properties towards 13 antimicrobial substances (12 active substance classes). The investigated MRSA isolates are subdivided below into those from livestock (laying hen, broiler, dairy and veal calf farms) and those from food (turkey carcasses at the abattoir, as well as broiler and turkey meat, pork and veal from food retailers).

Almost half of the isolates (434; 45.8 %) originated from investigations in the food chain turkey, coming from the neck skin of turkey carcasses at the abattoir (194; 20.5 %) and turkey meat from food retailers (240; 25.3 %). Isolates from retail broiler meat (158; 16.7 %), pork (163; 17.3 %) and veal (58; 6.1 %) were also investigated.

84.5 % of the isolates from livestock (N=133) originated from nose swabs of veal calves at the abattoir. In contrast, hardly any isolates from dust samples of laying hen flocks (3; 2.3 %) and broiler flocks (1; 0.8 %) were submitted and only a few (14; 10.5 %) from tank milk in dairy herds.

13.2 *Spa* types and resistances

Of the 946 isolates investigated in the course of zoonosis monitoring, 943 were *spa* typable. These were mainly (89.2 %) *spa* types assigned to the clonal complex CC398 associated with livestock. The majority of these isolates belonged to the *spa* types t011 (54.5 %) and t034 (28.5 %). In 102 isolates (10.8 %), the molecular biological examinations identified other *spa* types not associated with clonal complex CC398. These are referred to below as non-CC398.

To present the spread of resistance in isolates from livestock and from food, epidemiologically coherent groups were formed by *spa* type: t011, t034, other CC398(-associated) and non-CC398. The presentation of the proportions of resistant isolates in the individual origins is done after dividing them into CC398-associated and non-CC398-associated groups. Non *spa* typable isolates were excluded from these presentations.

The majority (45.9 %, N=434) of all isolates originated from the food chain turkey, from which the most (46.1 %, N=47) non-CC398 types were isolated (Fig. 13.2). Another large proportion (37.3 %) of non-CC398 isolates was attributable to broiler meat in food retail businesses. Three isolates (two from turkey meat and one from pork) were not *spa* typable and were excluded from the presentation in the corresponding sub-chapters 13.4.3 and 13.4.5. An overview of the *spa* types determined in zoonosis monitoring 2009 is contained in Fig. 13.1 and Fig. 13.2.

Overall, the investigated MRSA isolates from livestock and food were resistant to one to eight substance classes, with 69.3 % of the isolates resistant to at least five antimicrobial substance groups. Isolates from broiler meat (82.3 %) and turkey meat (80.5 %) in particular showed high rates of resistance to at least five substance classes (Fig. 13.3).

Fig. 13.1: Proportion of the *spa* types in MRSA isolates from animals (zoonosis monitoring 2009)

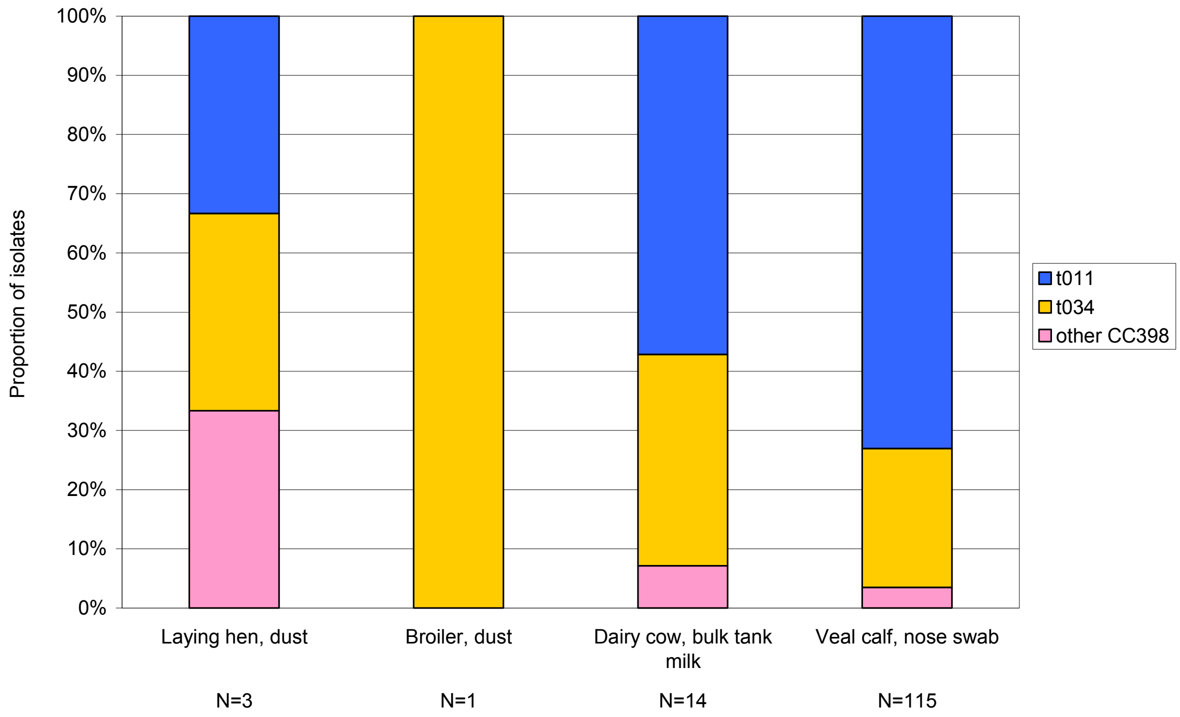


Fig. 13.2: Proportion of the *spa* types in MRSA isolates from food (zoonosis monitoring 2009)

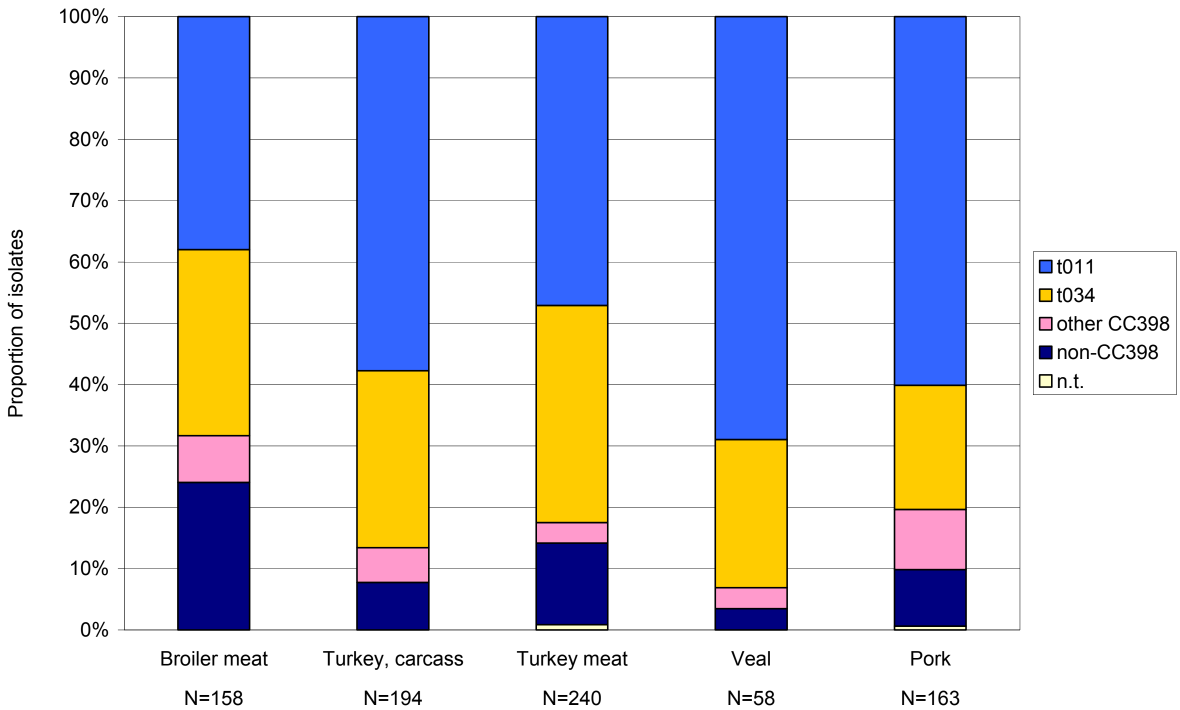
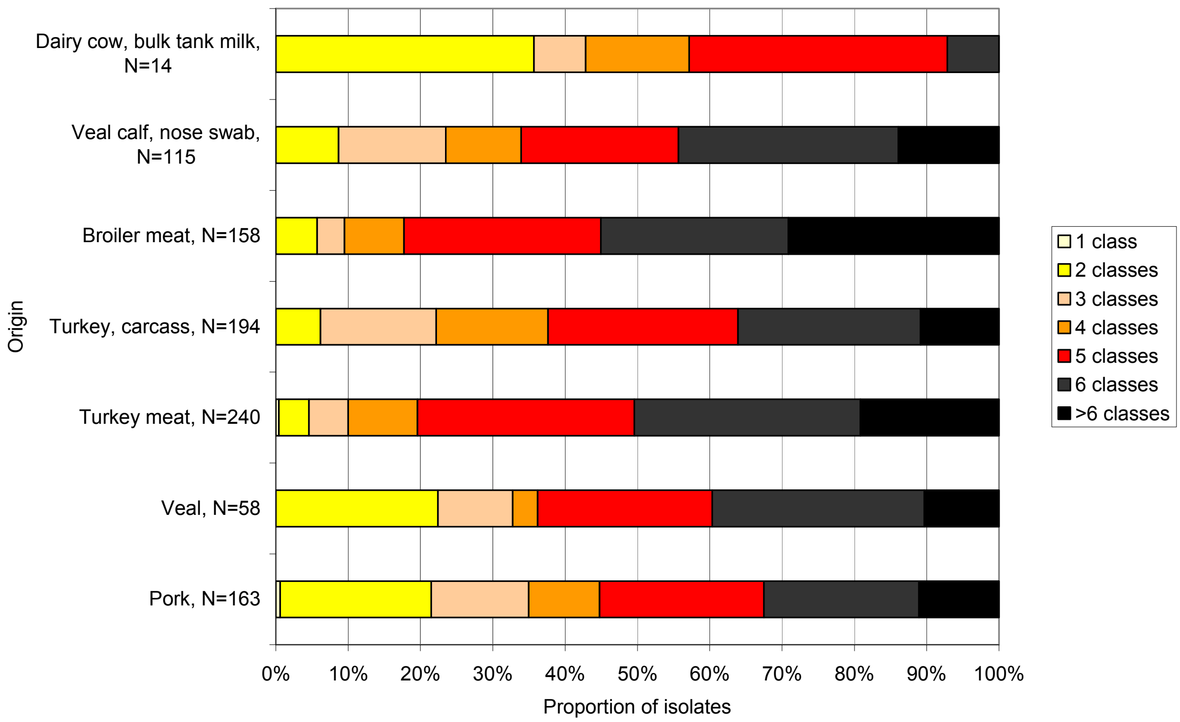


Fig. 13.3: Resistance of MRSA isolates from zoonosis monitoring 2009. Number of classes of antimicrobials the isolates were resistant to



13.3 Isolates from livestock

A total of 133 MRSA isolates were investigated. Their rates of resistance to active substance classes and individual active substances are displayed graphically in Fig. 13.4 and Fig. 13.5. The isolates from laying hen (N=3) and broiler flocks (N=1) were not shown separately.

13.3.1 Laying hens and broilers

A total of three isolates from laying hens were investigated which were assigned to ST398 based on their *spa* types. One isolate was resistant to three (t1451), one to six (t034) and one to more than six (t011) substance classes. No resistance to chloramphenicol, mupirocin, linezolid and vancomycin was observed.

One isolate from the dust of a broiler flock was typed. This was an isolate with the *spa* type t034, which was resistant to six substance classes. No resistance to ciprofloxacin, gentamicin, kanamycin, linezolid, mupirocin or vancomycin was observed.

Fig. 13.4: Resistance of MRSA isolates from veal calves and dairy cattle by *spa* tpes. Number of classes of antimicrobials the isolates were resistant to

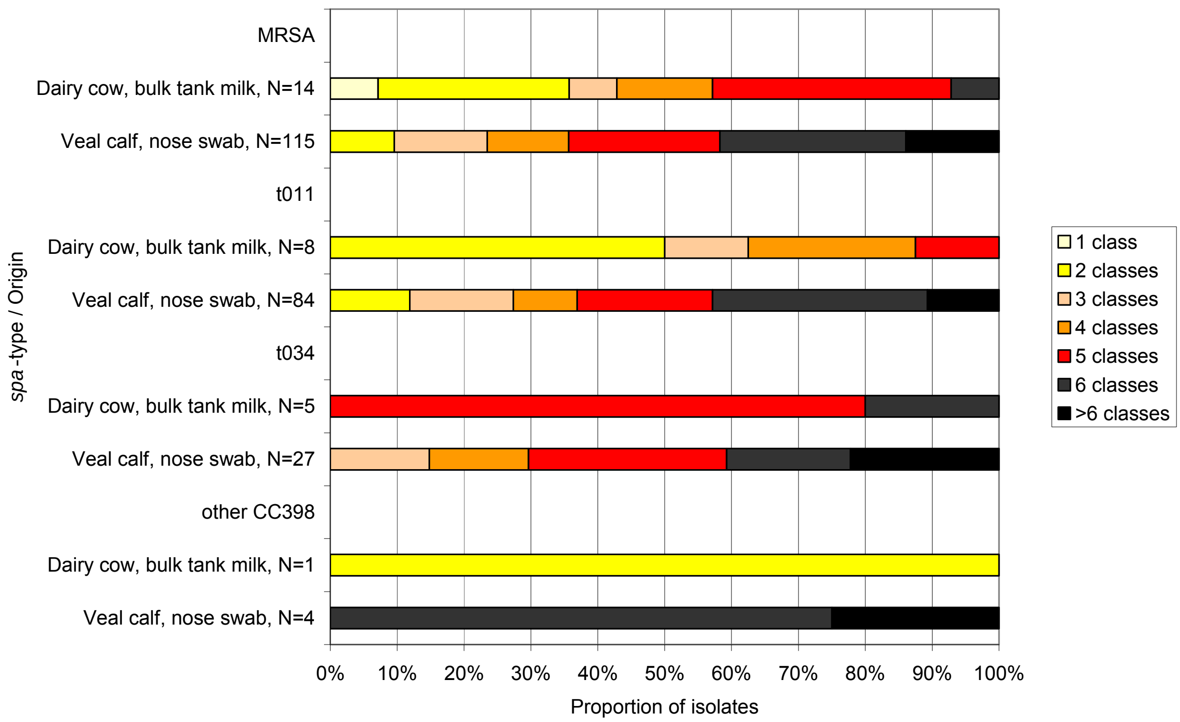
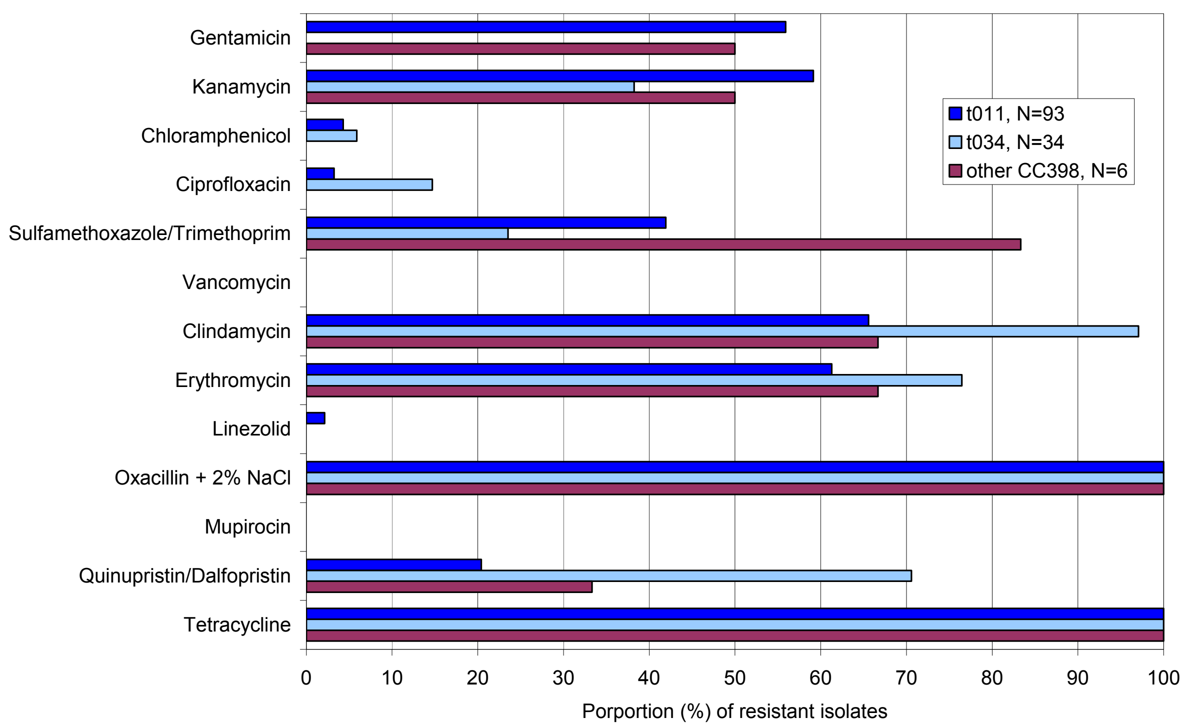


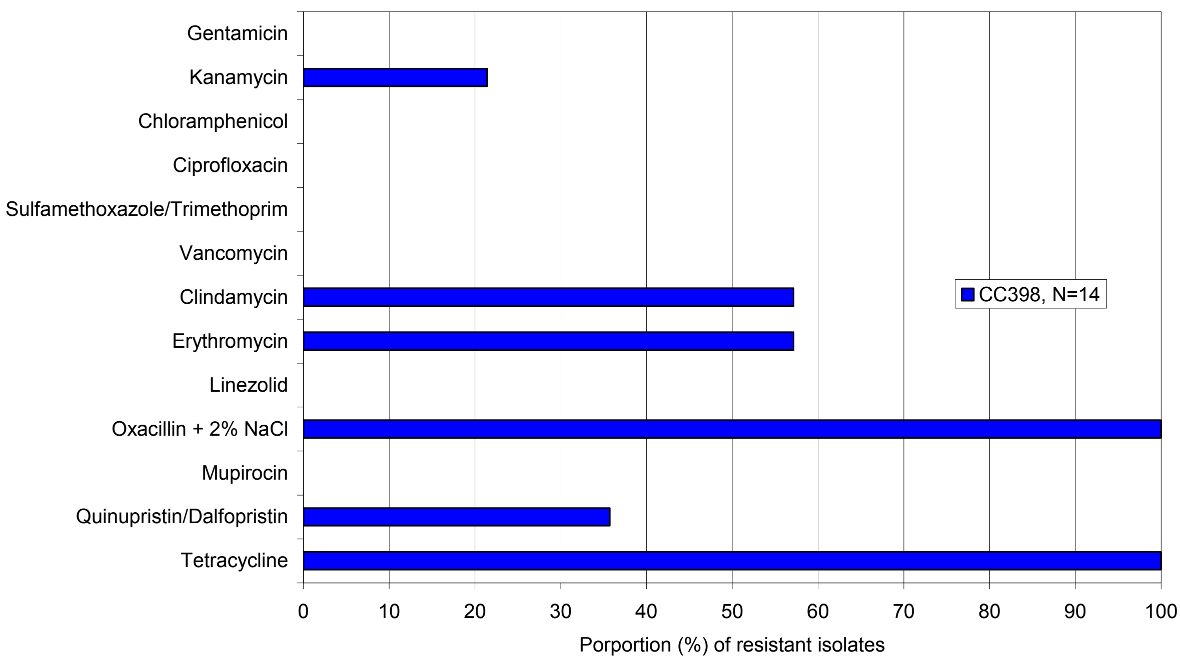
Fig. 13.5: Resistance of MRSA isolates from animal of the zoonosis monitoring 2009 to antimicrobial substances by *spa* types



13.3.2 Dairy cattle

Dairy cattle herds were examined for MRSA in bulk tank milk. A total of 14 isolates were obtained and typed. They all belonged to the CC398 complex and with one exception, to *spa* types t011 and t034. Resistance to two to six substance classes were observed. Five isolates were resistant to five and another five to two active substance groups. In isolates of *spa* type t034 (N=5), only multiple resistance to five and more active substance groups was observed. No resistance to gentamicin, chloramphenicol, ciprofloxacin, sulfamethoxazole/trimethoprim, mupirocin, linezolid or vancomycin was detected (Fig. 13.6).

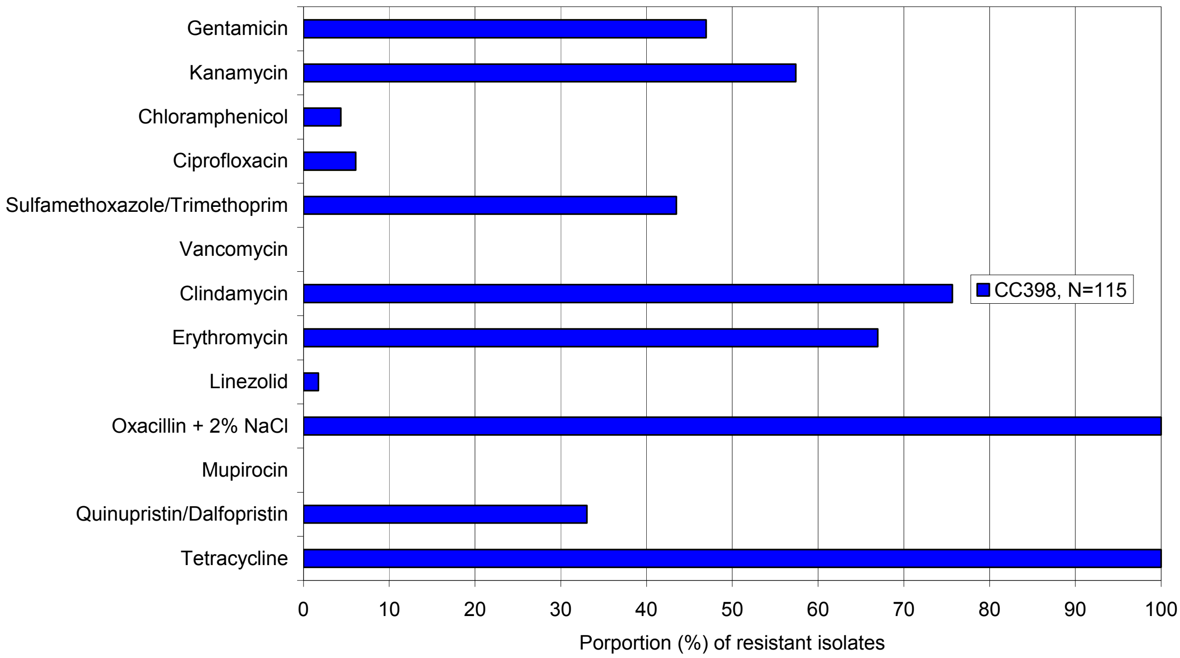
Fig. 13.6: Resistance of MRSA isolates from bulk tank milk from dairy herds to antimicrobial substances



13.3.3 Veal calves

A total of 115 isolates from the nose swabs of veal calves at the abattoir were investigated (Fig. 13.7). *Spa* typing resulted exclusively in CC398-associated types, mainly t011 (73.0 %) and t034 (23.5 %). Resistance to two to eight substance classes were measured. The largest proportion (30.4 %) of the isolates was resistant to six substance classes. The majority (70.4 %) of the isolates of *spa* type t034 (N=27) was resistant to at least five antimicrobial substance groups. Of the isolates with the *spa* type t011 (N=84), 63.1 % were resistant to at least five substance classes. None of the isolates showed resistance to mupirocin or vancomycin.

Fig. 13.7: Resistance of MRSA isolates from nose swabs of veal calves at the abattoir to antimicrobial substances



13.4 Isolates from food

813 of the investigated MRSA isolates from zoonosis monitoring 2009 originated from food. The determined resistance rates to substance classes and, to the extent that they were *spa* typable, to individual antimicrobials are summarised in Figures 13.8 to 13.10.

Fig. 13.8: Resistance of MRSA isolates from food by *spa* types. Number of classes of antimicrobials the isolates were resistant to

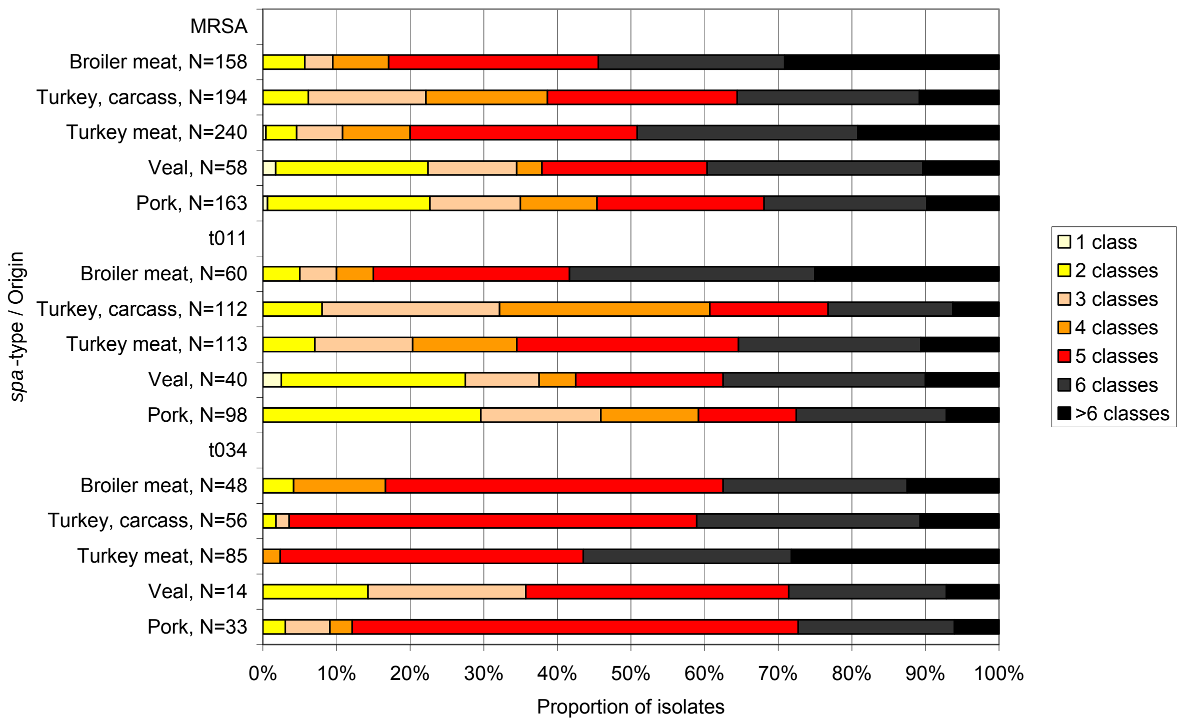


Fig. 13.9: Resistance of MRSA isolates from food by *spa* types. Number of classes of antimicrobials the isolates were resistant to

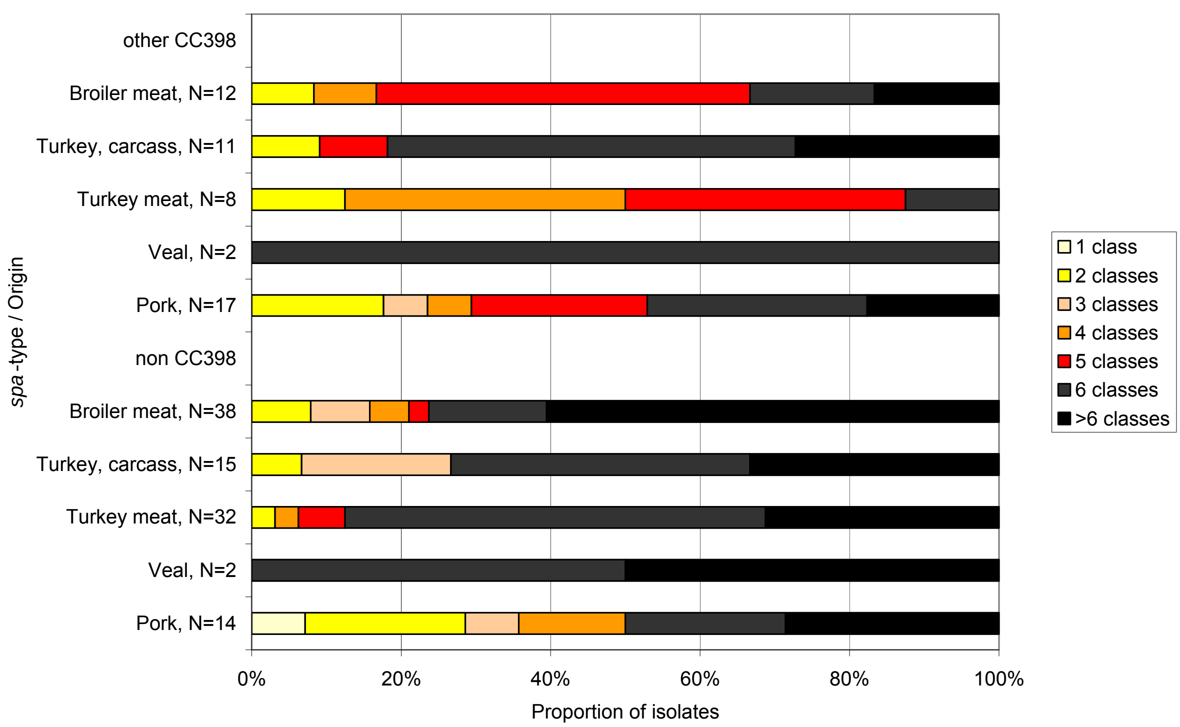
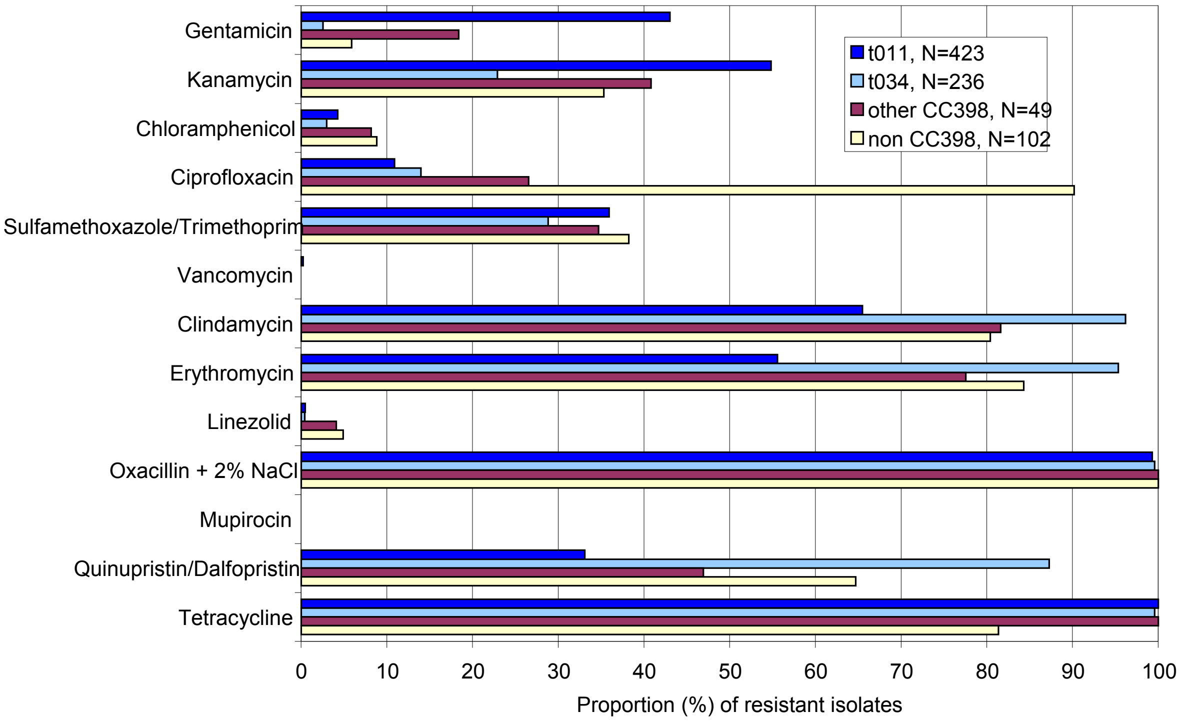


Fig. 13.10: Resistance of MRSA isolates from food of zoonosis monitoring 2009 to antimicrobial substances by *spa* type

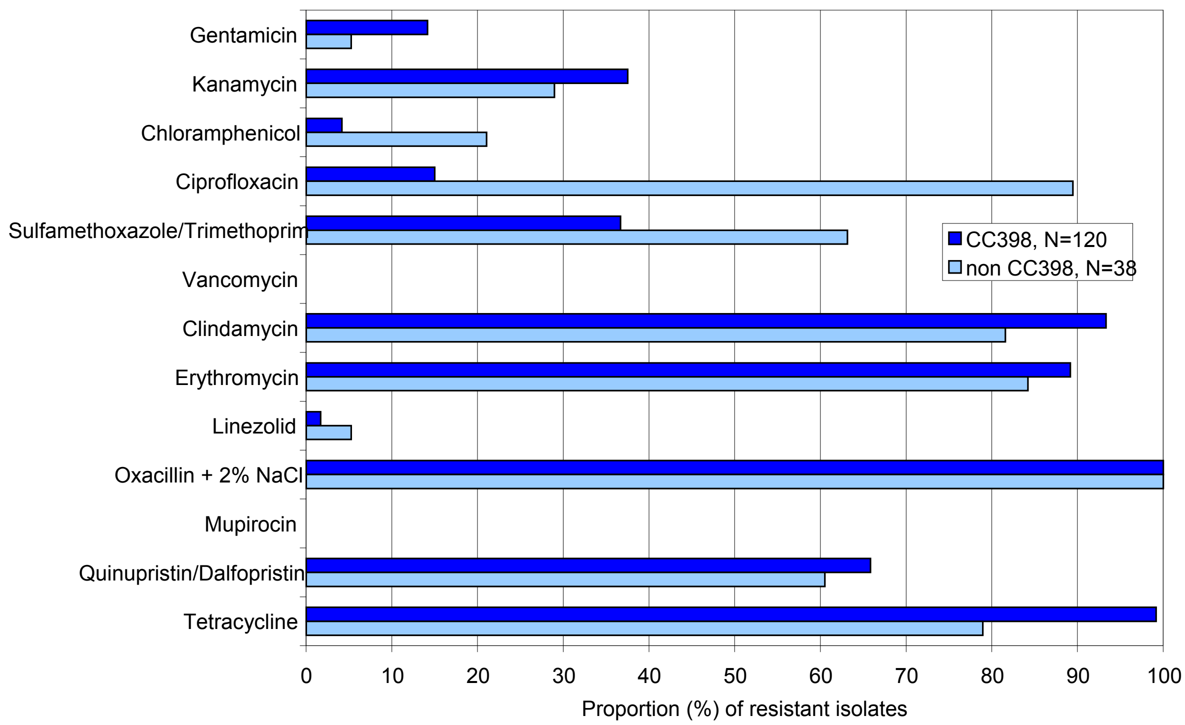


13.4.1 Broiler meat

The great majority of MRSA isolates from broiler meat belonged to the *spa* types t011 (38.0 %) and t034 (30.4 %) which occur most frequently in agriculture. Of the foods examined, the largest proportion of non-CC398 isolates (24.1 %) was obtained from broiler meat. Of these non-CC398 isolates, 84.2 % belonged to the *spa* type t1430, which is categorised to the clonal complex CC9.

Overall, resistance was observed to two to eight substance classes, whereby 82.3 % of the isolates were resistant to at least five antimicrobial substance groups. High rates of resistance to clindamycin (90.5 %), erythromycin (88.0 %) and the streptogramin combination quinupristin/dalfopristin (64.6 %) were observed. Mainly non-CC398 MRSA isolates were resistant to ciprofloxacin and chloramphenicol (Fig. 13.11). No resistance to mupirocin or vancomycin was determined.

Fig. 13.11: Resistance of MRSA isolates from broiler meat to antimicrobial substances by clonal complex

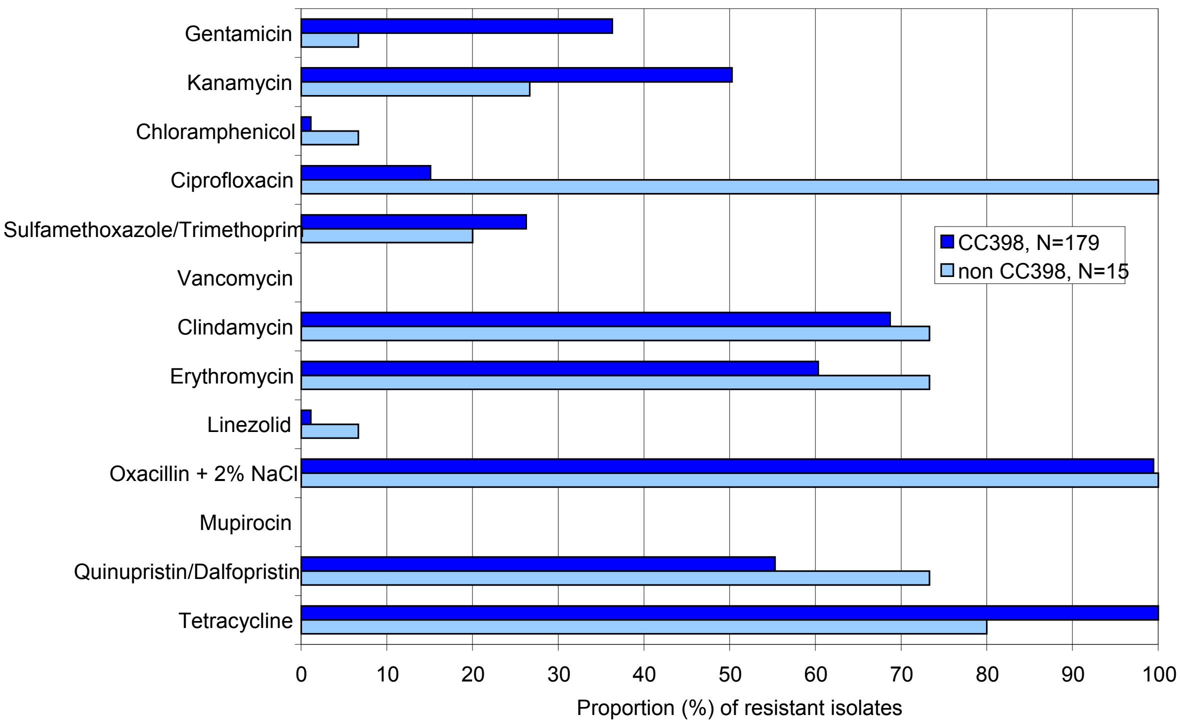


13.4.2 Turkey carcasses

194 isolates which showed resistance to two to eight substance classes were obtained at the abattoir from the neck skin of turkey carcasses. The majority of these were *spa* types t011 (57.7 %) and t034 (28.9 %). Non-CC398 *spa* types were determined with 7.7 % (N=15). Of these, seven isolates were categorised to *spa* type t1430 (CC9) and a further seven to t002 (CC5).

Resistances to at least five antimicrobial substance groups were observed with 62.4 % of the isolates. As with those from broiler meat, high rates of resistance to clindamycin (69.1 %), erythromycin (61.3 %) and the streptogramin combination quinupristin/dalfopristin (56.7 %) were observed with this origin too. All non-CC398 MRSA isolates were resistant to ciproflox-acin, whereas only 13.9 % of the CC398 isolate were resistant to ciprofloxacin (Fig. 13.12). No resistances to mupirocin or vancomycin were determined.

Fig. 13.12: Resistance of MRSA isolates from turkey carcasses to antimicrobial substances by clonal complex

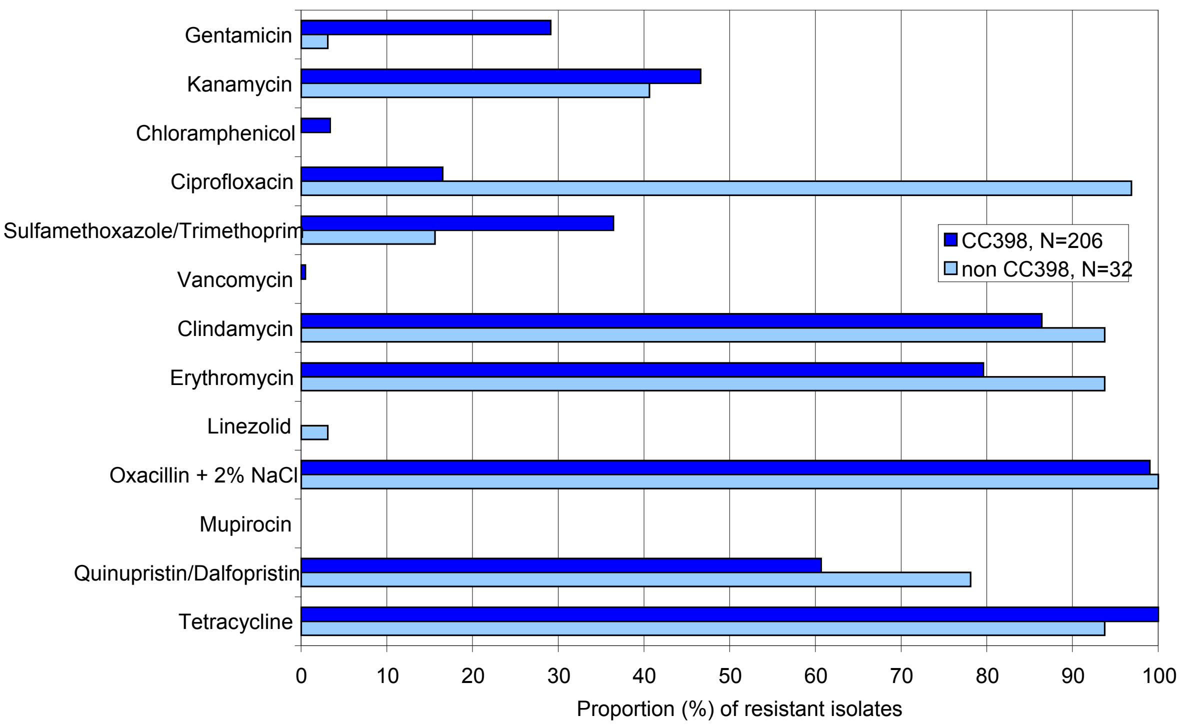


13.4.3 Turkey meat

238 of the 240 isolates obtained from retail turkey meat were *spa* typable. Of these, 47.5 % belonged to *spa* type t011 and 35.7 % to t034. 13.4 % (N=32) of the isolates belonged to the non-CC398 *spa* types, of which five (15.6 %) were categorised to type t1430 (CC9) and 27 (84.4 %) to type t002 (CC5).

The isolates were resistant to one to eight antimicrobial substance groups with a considerable proportion (81.1 %) of resistant isolates to at least five substance classes. Similar to the isolates from broiler meat and turkey carcasses, high rates of resistance to clindamycin (87.1 %), erythromycin (81.3 %) and the streptogramin combination quinupristin/dalfopristin (62.9 %) were also determined with turkey meat. Almost all (31/32) non-CC398 MRSA isolates were resistant to ciprofloxacin, but only 14.3 % of the CC398 isolates (Fig. 13.13). No resistance to mupirocin was determined. One isolate (t011) was resistant to vancomycin.

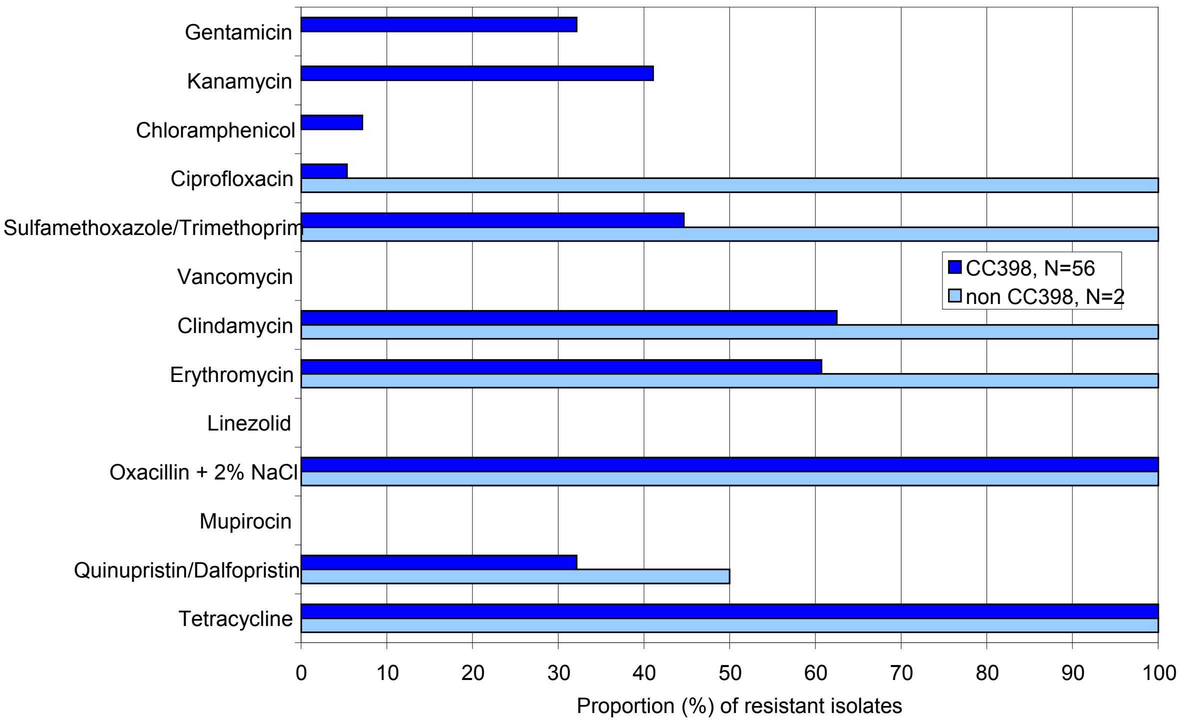
Fig. 13.13: Resistance of MRSA isolates from turkey meat to antimicrobial substances by clonal complex



13.4.4 Veal

Most of the isolates (96.5 %) from veal at retail belonged to the CC398-associated *spa* types (69.0 % t011 and 24.1 % t034). Overall, resistance to two to eight antimicrobial substance groups was observed (Fig. 13.14). 22.4 % of the isolates (N=13) were only resistant to oxacillin and tetracycline. In contrast, 63.8 % of the isolates were resistant to at least five substance classes. Among the CC398 isolates, high rates of resistance to clindamycin (63.8 %), erythromycin (62.1 %), sulfamethoxazole/trimethoprim (46.6 %) and other substances were determined. The two non-CC398-associated isolates belonged to *spa* type t1430 (CC9) and were resistant to ciprofloxacin, sulfamethoxazole/trimethoprim, clindamycin, erythromycin, tetracycline and oxacillin. No isolates from veal that were resistant to mupirocin, linezolid or vancomycin were detected.

Fig. 13.14: Resistance of MRSA isolates from veal to antimicrobial substances by clonal complex



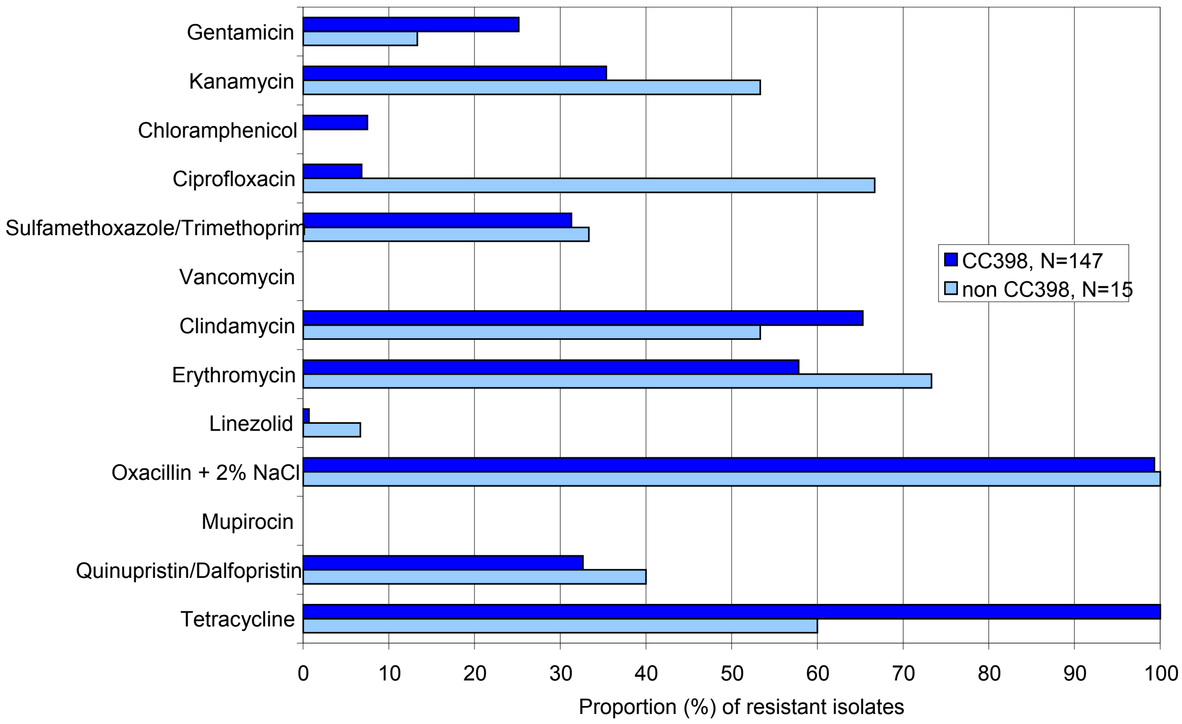
13.4.5 Pork

It was possible to *spa* type 162 of the 163 pork isolates obtained. Of these, the great majority belonged to the *spa* types t011 (60.5 %) and t034 (20.4 %). Less than ten percent (9.3 %) of the typable isolates belonged to non-CC398 types (Fig. 13.15).

The isolates were resistant to up to eight substance classes, whereby more than half (54.9 %) were resistant to at least five antimicrobial substance groups. In contrast, a proportion of 19.1 % only showed resistance to oxacillin and tetracycline.

The highest resistance rates were determined for clindamycin (64.2 %), erythromycin (59.3 %) and quinupristin/dalfopristin (33.3 %). The high proportion of ciprofloxacin-resistant non-CC398 isolates (66.7 %) to CC398 isolates (12.3 %) in pork was also remarkable. No isolates were detected with resistance to mupirocin or vancomycin.

Fig. 13.15: Resistance of MRSA isolates from pork to antimicrobial substances by clonal complex

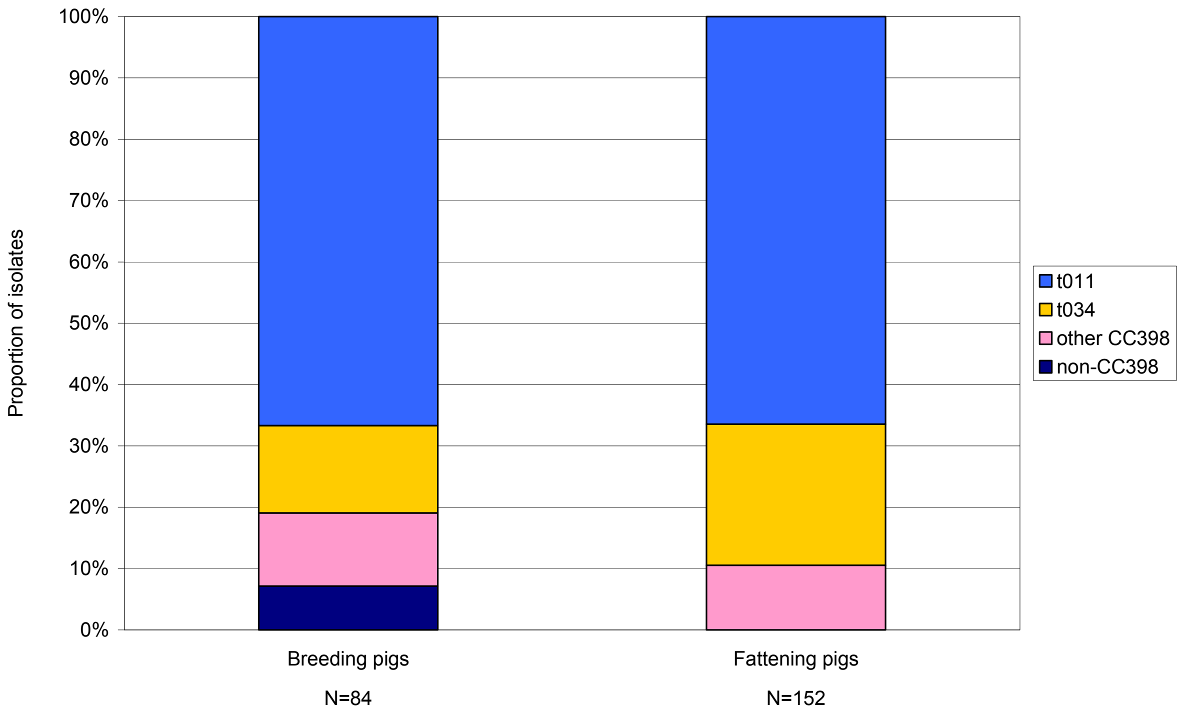


14 Methicillin-resistant *Staphylococcus aureus* (MRSA) from other studies

In 2008, 201 breeding pig herds representative of all of Germany were investigated for MRSA in dust from the barns within the scope of a baseline study conducted throughout the EU (Decision 2008/55/EC). Building methodically on this, a total of 290 fattening pig herds were investigated the same year for the prevalence of MRSA. 84 MRSA isolates were obtained from German breeding pig herds and 152 from fattening pigs and tested for their resistance to 13 antimicrobial substances.

Figure 14.1 shows an overview of the *spa* types determined in the two studies.

Fig. 14.1: Proportion of the *spa* types in MRSA isolates from breeding and fattening pig herds



14.1 Isolates from German breeding pig herds

Mainly isolates with CC398-associated *spa* types were obtained from breeding pig herds, most of them t011 (66.7 %) and t034 (14.3 %) (Fig. 14.1). Three isolates were categorised to the MLST type ST97 (two t3992 and one t5487), two to type ST39 (t007) and one to the type ST9 (t1430).

Overall, the isolates were resistant to up to eight substance classes, but 33.3 % of them were resistant to at least five antimicrobial groups. Resistance only to oxacillin and tetracycline was observed in 14.3 % of the isolates. A presentation of resistance to the tested substance classes by *spa* type is shown in Figures 14.2 and 14.3. Among the individual antimicrobial substances, the isolates from breeding pig herds were particularly resistant to clindamycin (59.5 %), erythromycin (45.2 %) and kanamycin (41.7 %). Three isolates (two t011 and one t3992) were insensitive to mupirocin. No vancomycin or linezolid-resistant isolates were detected.

Fig. 14.2: Resistance of MRSA isolates from breeding pigs by *spa* types. Number of classes of antimicrobials the isolates were resistant to

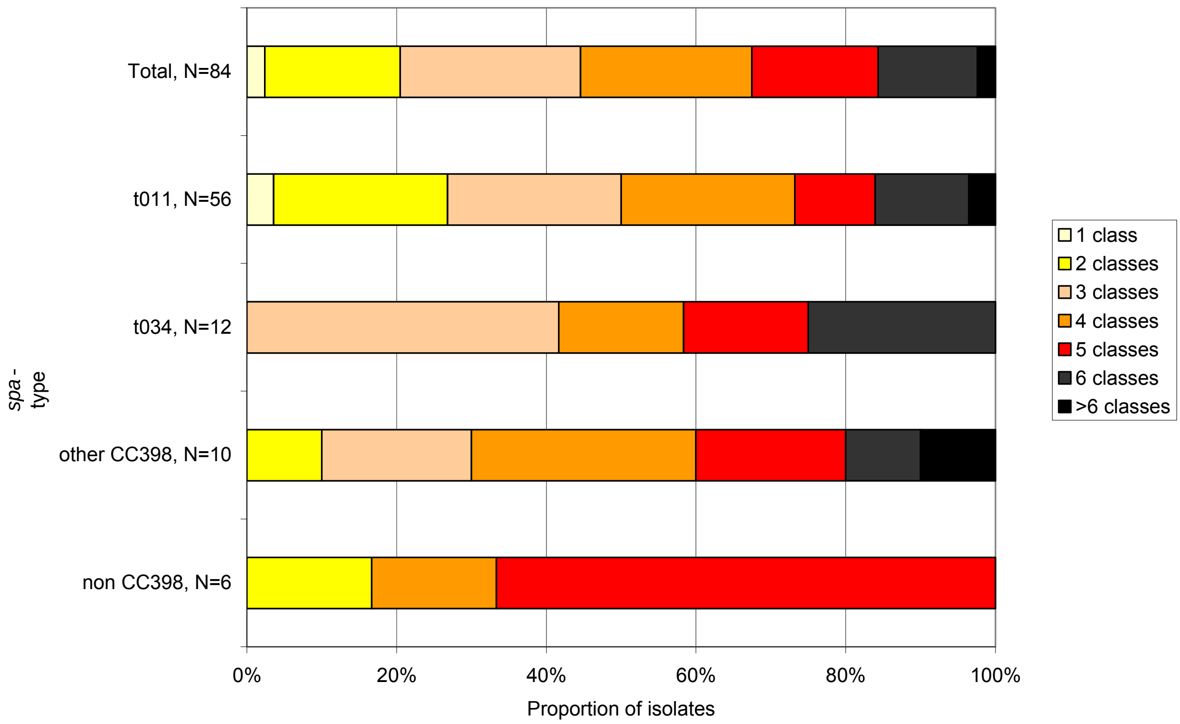
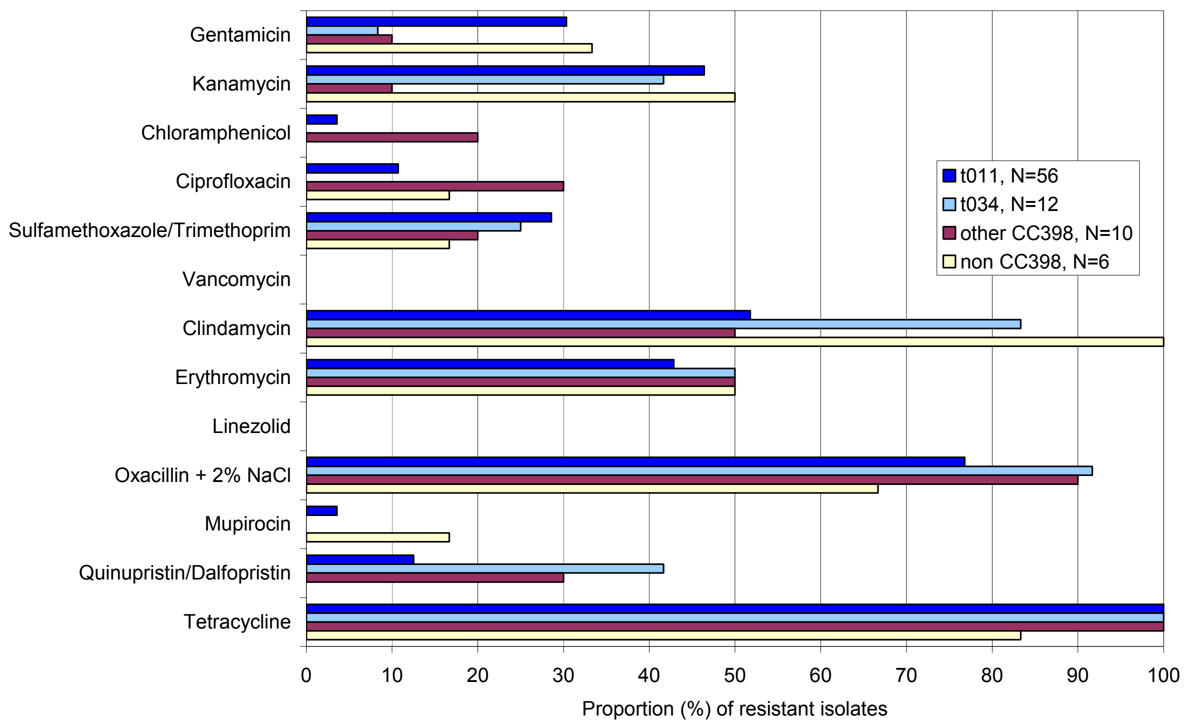


Fig. 14.3: Resistance of MRSA isolates from breeding pigs to antimicrobial substances



14.2 Isolates from fattening pig herds

Only CC398-associated *spa* types were detected with MRSA isolates from fattening pig herds, most of them t011 (66.4 %) and t034 (23.0 %), which were resistant to up to nine antimicrobial substance classes (Fig. 14.4). Resistance to at least five antimicrobial substance groups was observed in 54.6 % of the isolates.

High proportions of resistant isolates were determined for clindamycin (68.4 %), erythromycin (61.2 %), kanamycin (49.3 %), sulfamethoxazole/trimethoprim (40.1 %) and quinupristin/dalfopristin (31.6 %). Mainly isolates of the *spa* type t034 (54.2 %) and other CC398-associated types (56.3 %) were involved in the high rate of resistance to quinupristin/dalfopristin. The highest resistance rate towards sulfamethoxazole/trimethoprim (44.6 %) was determined with isolates with the *spa* type t011. No resistances to mupirocin, linezolid or vancomycin were observed (Fig. 14.5).

Fig. 14.4: Resistance of MRSA isolates from fattening pig herds by *spa* types (2008/2009). Number of classes of antimicrobials the isolates were resistant to

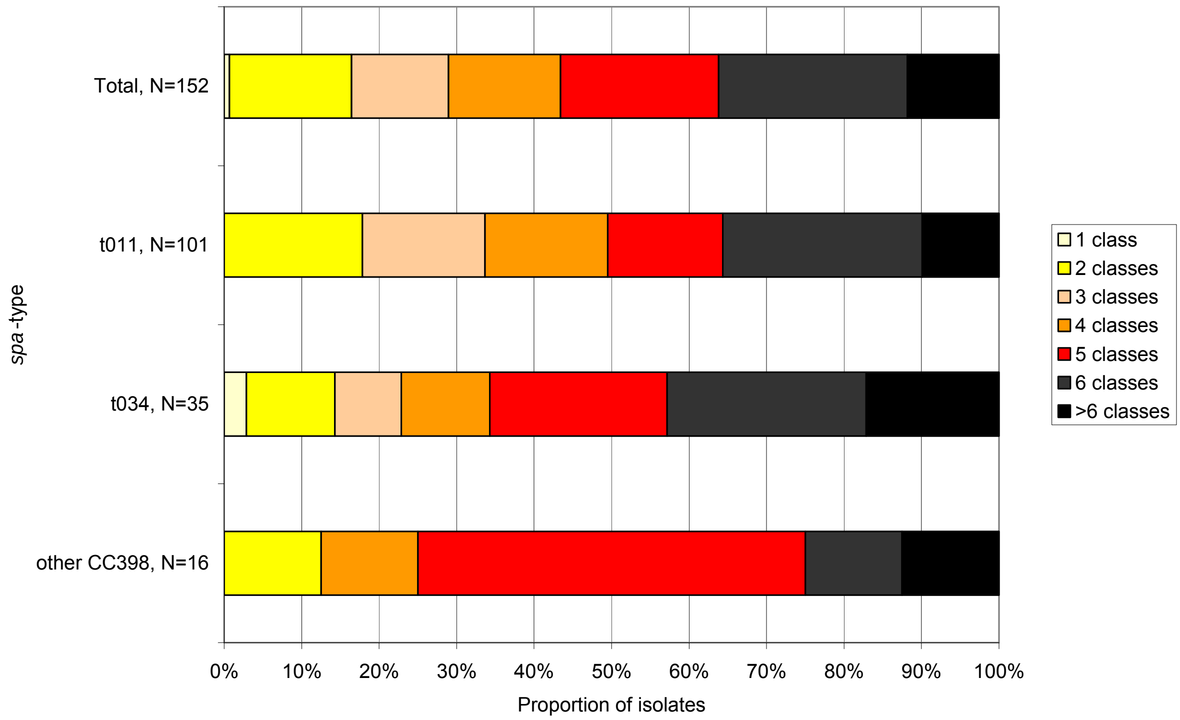
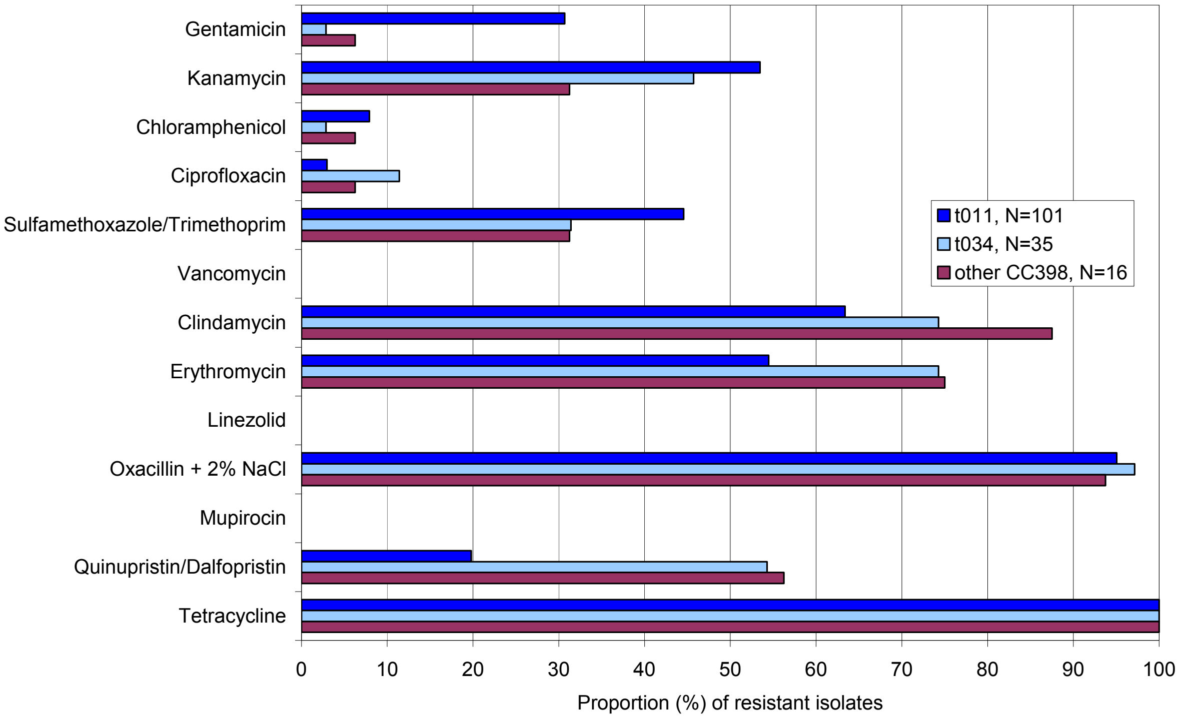


Fig. 14.5: Resistance of MRSA isolates from fattening pigs to antimicrobial substances (2008/2009)

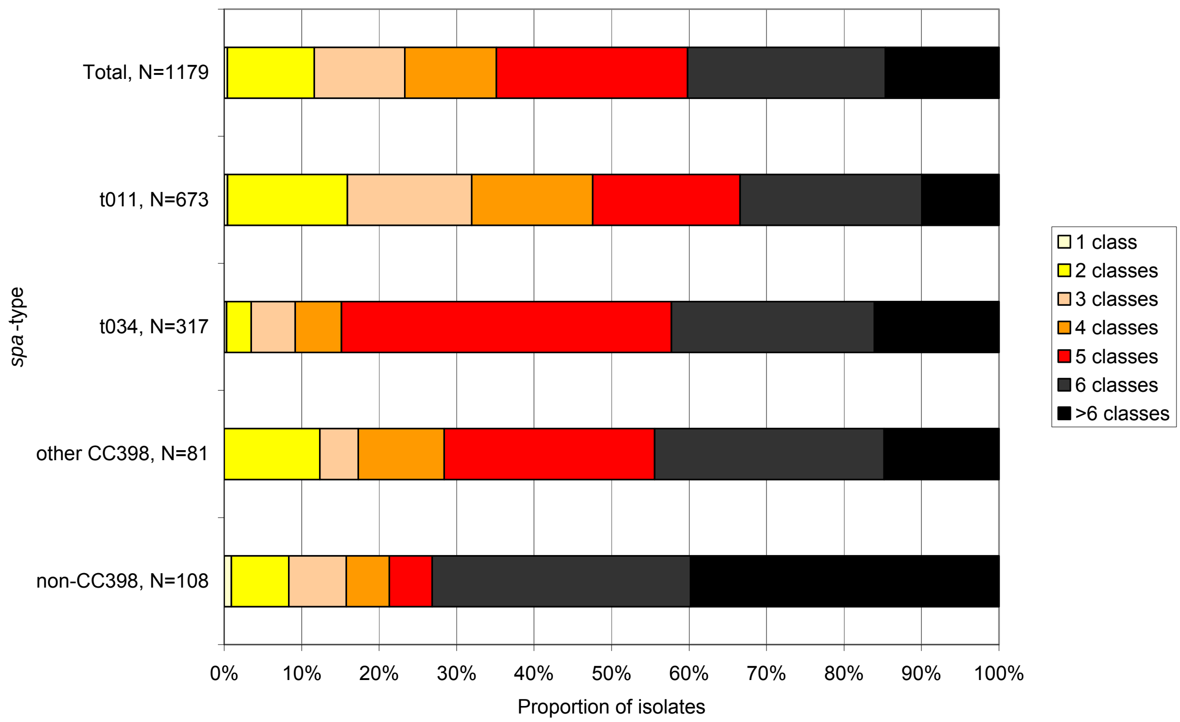


15 Methicillin-resistant *Staphylococcus aureus* (MRSA): Comparison of resistances between isolates with CC398-associated and non-CC398-associated *spa* types by their origin

In the years 2008 and 2009, a total of 1,179 *spa* typable MRSA isolates from different origins were obtained in primary production, food production and the retail sector, all of which were tested for their resistance properties using a uniform method.

In the overall observation of resistance profiles to antimicrobial substance classes by epidemiologically coherent groups (t011, t034, other CC398 and non-CC398), significant differences were noticed in the distribution of resistance characteristics. Whereas almost a third (31.4 %) of the isolates of *spa* type t011 was resistant to a maximum of three antimicrobial substance classes, this was less than a tenth (9.2 %) with *spa* type t034. In contrast, 84.9 % of the isolates of type t034 and 71.6 % of the isolates of other CC398-associated types were resistant to at least five antimicrobial substance classes, while this was only 52.5 % with type t011. With other clonal lines (non-CC398), it was striking that they showed a considerably higher proportion of resistances to more than six antimicrobial substance classes (39.8 %) compared to CC398-associated isolates (Fig. 15.1).

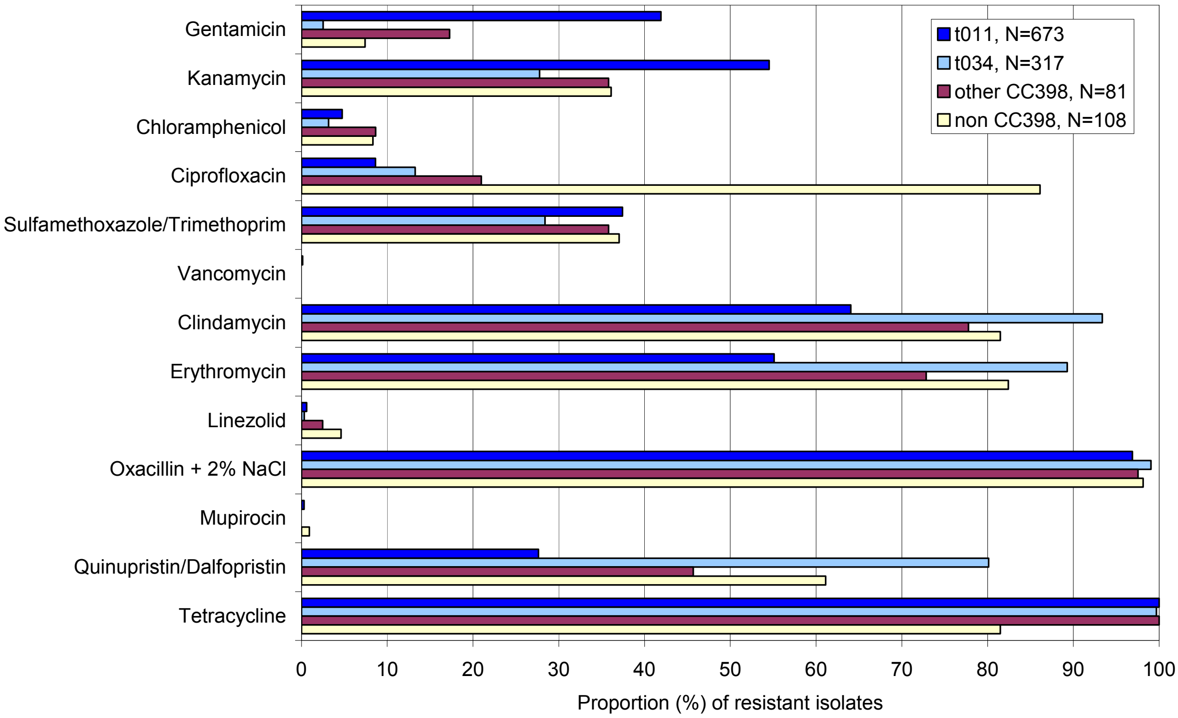
Fig. 15.1: Resistance of *spa* typed MRSA isolates from primary production, food harvest and food at retail by *spa* types. Number of classes of antimicrobials the isolates were resistant to



When observing resistances to individual antimicrobial substances, differences between the *spa* types t011 and t034 became apparent (Fig. 15.2). 41.9 % of t011 isolates were resistant compared to 2.5 % of the isolates of type t034. The proportion of resistances to the second tested aminoglycoside kanamycin was also significantly higher (54.5 %) with t011 isolates than with isolates of type t034 (27.8 %). Resistance rates towards clindamycin and erythromycin, on the other hand, were 29.4 % and 34.2 % higher with isolates of *spa* type t034 than those of *spa* type t011. With quinuptistin/dalfopristin, as many as 52.5 % more isolates of type t034 were resistant than those of type t011.

The vast majority (86.1 %) of isolates of other clonal lines (non-CC398) were resistant to the tested fluoroquinolone ciprofloxacin, as opposed to isolates of clonal line CC398 (< 21 %).

Fig. 15.2: Resistance of MRSA isolates from primary production, food harvest and food at retail to antimicrobial substances



16 List of abbreviations

Fig.	Figure
BfR	Bundesinstitut für Risikobewertung – Federal Institute for Risk Assessment
BgVV	Bundesinstitut für gesundheitlichen Verbraucherschutz und Veterinärmedizin – Federal Institute for Health Protection for Consumers and Veterinary Medicine
CLSI	Clinical and Laboratory Standards Institute
DNA	Desoxyribonukleinsäure
ECOFF	Epidemiological cut off
EFSA-CSR	European Food Safety Authority – Community Summary Report
EC	European Community
EUCAST	European Committee on Antimicrobial Susceptibility Testing
FLI	Friedrich-Loeffler-Institute – Federal Research Institute for Animal Health
MIC	Minimum Inhibitory Concentration
N	Number of samples
NCCLS	National Committee on Clinical Laboratory Standards
NRL AR	National Reference Laboratory for Antimicrobial Resistance
NRL Salm	National Reference Laboratory for Salmonella
PCR	Polymerase Chain Reaction
RDNC	Non typeable („react but did not conform“)
RKI	Robert Koch-Institute (Federal Institute for Health)
S.	*Salmonella*
spp.	Species
ssp.	Subspecies
Tab.	Table
vs.	versus
WHO	World Health Organization

17 List of figures

18 List of tables

19 References

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20 Appendix

20.1 *Salmonella* isolates by category of origin

20.1.1 Distribution of serovars

Tab. 20.1: Number and share of the 20 most frequent serovars according to their origin environment, feeding stuffs, animals and food and in all isolates (2009)

Origin	Total		Environment		Feeding stuffs		Animals		Foodstuffs	
Serovar	N	%	N	%	N	%r	N	%	N	%
S. Typhimurium	777	24,3	69	30,3	17	9,0	506	26,6	185	21,0
S. 4,[5],12:i:-	412	12,9	23	10,1	19	10,1	212	11,2	158	17,9
S. Enteritidis	340	10,6	22	9,6	1	0,5	212	11,2	105	11,9
S. Subspec. IIIb	176	5,5	1	0,4	0	0,0	175	9,2	0	0,0
S. Subspec. I, rough	87	2,7	8	3,5	4	2,1	42	2,2	33	3,7
S. Derby	83	2,6	5	2,2	1	0,5	25	1,3	52	5,9
S. Infantis	80	2,5	11	4,8	5	2,7	24	1,3	40	4,5
S. Senftenberg	75	2,3	7	3,1	13	6,9	18	0,9	37	4,2
S. Saintpaul	68	2,1	3	1,3	0	0,0	39	2,1	26	2,9
S. ParatyphiBdT+	63	2,0	9	3,9	0	0,0	16	0,8	38	4,3
S. Subspec. IV	62	1,9	0	0,0	0	0,0	62	3,3	0	0,0
S. Dublin	52	1,6	0	0,0	0	0,0	41	2,2	11	1,2
S. Livingstone	49	1,5	11	4,8	12	6,4	18	0,9	8	0,9
S. Subspec. IIIa	49	1,5		0,0		0,0	49	2,6		0,0
S. Newport	40	1,3	1	0,4	0	0,0	14	0,7	25	2,8
S. Anatum	38	1,2	10	4,4	4	2,1	14	0,7	10	1,1
S. Ohio	35	1,1	2	0,9	11	5,9	13	0,7	9	1,0
S. Mbandaka	34	1,1	4	1,8	5	2,7	20	1,1	5	0,6
S. London	28	0,9	1	0,4	3	1,6	13	0,7	11	1,2
S. Montevideo	28	0,9	5	2,2	10	5,3	13	0,7	0	0,0
S. Indiana	28	0,9	3	1,3	0	0,0	16	0,8	9	1,0
S. Tennessee	28	0,9	3	1,3	7	3,7	17	0,9	1	0,1
S. Subspec. II	24	0,8	0	0,0	0	0,0	21	1,1	3	0,3
S. Brandenburg	22	0,7	1	0,4	3	1,6	9	0,5	9	1,0
S. Virchow	22	0,7		0,0	1	0,5	16	0,8	5	0,6
S. 4,12:d:-	19	0,6	1	0,4	2	1,1	8	0,4	8	0,9
S. Kottbus	17	0,5	4	1,8		0,0	9	0,5	4	0,5
S. Kisarawe	17	0,5		0,0		0,0	16	0,8	1	0,1
S. Hadar	14	0,4		0,0	1	0,5	4	0,2	9	1,0
S. Havana	13	0,4	0	0,0	6	3,2	6	0,3	1	0,1
S. Agona	12	0,4	1	0,4	5	2,7	1	0,1	5	0,6
S. of group C1	12	0,4	2	0,9		0,0	9	0,5	1	0,1
S. Bovismorbificans	11	0,3	1	0,4		0,0	3	0,2	7	0,8
S. Cerro	9	0,3		0,0	4	2,1	1	0,1	4	0,5
S. Schwarzengrund	9	0,3	3	1,3	3	1,6	2	0,1	1	0,1
S. Monschaui	8	0,3	2	0,9		0,0	6	0,3		0,0
S. Falkensee	7	0,2	0	0,0	7	3,7	0	0,0	0	0,0
S. Give	7	0,2	2	0,9	1	0,5	2	0,1	2	0,2
*S.*Orion	6	0,2	1	0,4	4	2,1		0,0	1	0,1
S. Idikan	3	0,1		0,0	3	1,6		0,0		0,0
Other serovars	336	10,5	12	5,3	36	19,1	229	12,0	59	6,7
Total	3.200	100,0	228	100,0	188	100,0	1.901	100,0	883	100,0

Yellow areas demark the top 20 serovars by category

Tab. 20.2: Development of frequency of the 20 most frequent serovars from all origins (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Total	3.898	3.532	4.322	3.577	3.572	4.013	3.551	3.747	3.413	3.200	36.825
S. Typhimurium	1.638	1.589	1.493	1.213	1.251	1.519	1.152	1.105	917	777	12.654
S. 4,[5],12:i:-	5	11	26	54	71	160	137	263	285	412	1.424
S. Enteritidis	443	435	605	490	275	348	394	475	440	340	4.245
S. Subspec. IIIb	44	61	77	70	65	64	63	92	81	176	793
S. Subspec. I, rough	61	77	113	73	66	96	53	76	99	87	801
S. Derby	78	56	66	70	77	180	125	120	111	83	966
S. Infantis	107	101	61	152	202	120	92	92	71	80	1.078
S. Senftenberg	109	92	88	67	104	68	76	50	52	75	781
S. Saintpaul	17	16	194	78	29	56	62	78	77	68	675
S. Paratyphi B dT+	211	62	103	75	83	56	74	87	84	63	898
S. Subspec. IV	17	34	40	29	34	56	37	53	60	62	422
S. Dublin	0	1	15	18	15	22	43	18	37	52	221
S. Subspec. IIIa	13	8	14	14	19	21	25	31	36	49	230
S. Livingstone	107	59	69	93	83	35	57	61	83	49	696
S. Newport	12	7	12	6	3	24	20	29	39	40	192
S. Anatum	89	44	71	171	86	94	102	65	42	38	802
S. Ohio	26	5	5	17	59	33	42	45	34	35	301
S. Mbandaka	54	65	79	46	51	24	14	32	43	34	442
S. Indiana	14	14	71	19	29	36	58	75	48	28	392
S. London	23	34	56	37	44	65	26	33	14	28	360
Other serovars	830	761	1064	785	926	936	899	867	760	624	8.452

Tab. 20.3: Development of frequency of the 20 most frequent serovars from the environment (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Total	301	267	255	359	244	166	299	352	184	228	2.655
S. Typhimurium	103	126	49	79	44	35	36	45	31	69	617
S. 4,[5],12:i:-	1	0	3	2	3	1	6	30	10	23	79
S. Enteritidis	63	18	44	35	32	6	41	29	34	22	324
S. Livingstone	10	16	46	35	22	18	27	18	13	11	216
S. Infantis	16	25	10	23	21	3	11	12	5	11	137
S. Anatum	2	2	5	24	8	10	10	9	1	10	81
S. Paratyphi B dT+	4	5	5	6	7	1	9	5	6	9	57
S. Subspec. I, rough	12	10	3	9	2	0	0	10	2	8	56
S. Senftenberg	12	5	11	8	10	12	41	18	11	7	135
S. Derby	10	1	2	14	3	4	6	8	4	5	57
S. Montevideo	1	1	2	2	1	1	2	6	5	5	26
S. Mbandaka	1	0	7	10	23	10	5	5	10	4	75
S. Kottbus	0	0	4	0	1	2	5	5	3	4	24
S. Tennessee	2	0	5	7	3	4	3	4	1	3	32
S. Saintpaul	1	1	5	5	1	0	5	6	0	3	27
S. Indiana	1	3	0	0	0	2	3	5	0	3	17
S. Schwarzengrund	0	0	0	0	0	2	1	6	0	3	12
S. Ohio	0	1	0	2	1	3	1	15	4	2	29
S. Give	2	3	1	0	1	1	0	0	2	2	12
S. of group C1	0	0	0	0	0	0	0	0	0	2	2
Other serovars	60	50	53	98	61	51	87	116	42	22	640

Tab. 20.4: Development of frequency of the 20 most frequent serovars from feeding stuffs (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Total	485	275	356	259	401	328	219	212	175	188	2.898
S. 4,[5],12:i:-	0	0	0	0	0	2	7	3	5	19	19
S. Typhimurium	27	15	8	6	13	25	17	27	20	17	17
S. Senftenberg	55	63	49	36	72	38	14	20	24	13	13
S. Livingstone	33	10	6	8	7	2	6	8	13	12	12
S. Ohio	20	1	1	11	52	13	1	5	16	11	11
S. Montevideo	32	1	5	9	7	16	12	4	1	10	10
S. Tennessee	13	25	6	27	96	46	9	2	6	7	7
S. Falkensee	23	15	0	1	15	13	0	0	0	7	7
S. Havana	13	1	15	18	33	10	8	3	1	6	6
S. Mbandaka	27	26	52	4	15	2	3	3	5	5	5
S. Agona	15	16	9	6	0	12	16	17	28	5	5
S. Infantis	4	7	3	2	12	0	1	2	4	5	5
S. Anatum	61	31	44	66	12	31	6	16	1	4	4
S. Cerro	4	1	52	7	1	5	6	22	0	4	4
S. Subspec. I, rough	2	2	0	1	1	1	1	6	2	4	4
S. Orion	5	3	0	0	0	1	1	0	1	4	4
S. Schwarzengrund	1	8	0	0	3	1	4	3	2	3	3
S. Idikan	2	0	1	1	2	1	4	2	0	3	3
S. London	4	2	0	0	0	0	1	0	1	3	3
S. Brandenburg	0	0	0	2	0	0	0	0	0	3	3
Other serovars	144	48	105	54	60	109	102	69	45	43	779

Tab. 20.5: Development of frequency of the 20 most frequent serovars from animals (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Total	1.953	2.004	2.272	1.931	1.953	1.711	1.754	1.974	2.083	1.901	19.536
S. Typhimurium	1.155	1.010	1.014	821	842	776	728	733	633	506	8.218
S. Enteritidis	137	209	295	189	117	130	138	195	254	212	1.876
S. 4,[5],12:i:-	0	5	10	27	42	46	67	147	174	212	730
S. Subspec. IIIb	42	57	77	70	62	62	58	89	77	175	769
S. Subspec. IV	17	34	40	29	33	55	36	51	60	62	417
S. Subspec. IIIa	12	8	14	14	19	21	24	31	36	49	228
S. Subspec. I, rough	24	33	48	34	25	35	29	42	57	42	369
S. Dublin	0	1	15	14	13	16	17	12	35	41	164
S. Saintpaul	3	10	124	62	13	36	21	31	33	39	372
S. Derby	31	24	17	36	46	31	43	50	60	25	363
S. Infantis	28	25	14	90	111	32	43	40	36	24	443
S. Subspec. II	25	17	20	7	25	24	22	24	25	21	210
S. Mbandaka	15	22	15	14	7	5	1	12	13	20	124
S. Livingstone	55	24	13	40	41	7	10	27	39	18	274
S. Senftenberg	37	18	19	16	9	6	16	5	11	18	155
S. Tennessee	4	8	7	0	4	8	7	8	11	17	74
S. Paratyphi B dT+	18	21	59	38	61	29	13	9	15	16	279
S. Virchow	23	15	49	54	32	6	9	3	3	16	210
S. Indiana	3	10	6	18	18	13	40	47	30	16	201
S. Kisarawe	0	2	0	0	1	9	5	13	14	16	60
Other serovars	324	451	416	358	432	364	427	405	467	356	4.000

Tab. 20.6: Development of frequency of the 20 most frequent serovars from foodstuffs (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Total	1.159	986	1.439	1.028	974	1.808	1.279	1.209	971	883	11.736
S. Typhimurium	353	438	422	307	352	683	371	300	233	185	3.644
S. 4,[5],12:i:-	4	6	13	25	26	111	57	83	96	158	579
S. Enteritidis	242	208	264	263	126	211	214	249	150	105	2.032
S. Derby	21	27	46	20	27	133	71	53	39	52	489
S. Infantis	59	44	34	37	58	85	37	38	26	40	458
S. Paratyphi B dT+	189	34	39	29	15	26	51	73	63	38	557
S. Senftenberg	5	6	9	7	13	12	5	7	6	37	107
S. Subspec. I, rough	23	32	62	29	38	60	23	18	38	33	356
S. Saintpaul	6	5	63	10	15	19	36	41	44	26	265
S. Newport	1	0	8	1	0	12	13	12	13	25	85
S. London	7	22	19	8	5	29	10	12	4	11	127
S. Dublin	0	0	0	4	2	6	24	6	2	11	55
S. Anatum	4	3	5	16	23	40	23	6	9	10	139
S. Hadar	9	10	26	9	10	18	51	40	16	9	198
S. Indiana	9	1	65	1	11	21	15	22	18	9	172
S. Brandenburg	12	17	15	11	13	18	13	1	12	9	121
S. Ohio	5	3	1	1	3	10	18	17	8	9	75
S. 4,12:d:-	8	6	42	8	28	14	26	8	9	8	157
S. Livingstone	9	9	4	10	13	8	14	8	18	8	101
S. Bovismorbificans	5	8	3	4	9	103	2	8	13	7	162
Other serovars	188	107	299	228	187	189	205	207	154	93	1.857

20.1.2 Resistance rates in Salmonella isolates

Tab. 20.7: Resistance rates in *Salmonella* spp. from all sources and the main categories (2009)

	Environment		Feeding stuffs		Animals		Foodstuffs		Total	
Antimicrobial tested	Microbiological resistant isolates (Number)	Microbiological resistant isolates (in %)	Microbiological resistant isolates (Number)	Microbiological resistant isolates (in %)	Microbiological resistant isolates (Number)	Microbiological resistant isolates (in %)	Microbiological resistant isolates (Number)	Microbiological resistant isolates (in %)	Microbiological resistant isolates (Number)	Microbiological resistant isolates (in %)
Susceptible	120	52,6	148	78,7	1.192	62,7	373	42,2	1.833	57,3
Resistant	108	47,4	40	21,3	709	37,3	510	57,8	1.367	42,7
Multiresistant (1)	91	39,9	36	19,1	555	29,2	433	49,0	1.115	34,8
Gentamicin	12	5,3	2	1,1	44	2,3	16	1,8	74	2,3
Kanamycin	23	10,1	1	0,5	79	4,2	40	4,5	143	4,5
Streptomycin	73	32,0	35	18,6	530	27,9	325	36,8	963	30,1
Chloramphenicol	15	6,6	5	2,7	141	7,4	89	10,1	250	7,8
Florfenicol	8	3,5	3	1,6	115	6,0	63	7,1	189	5,9
Cefotaxime	0	0,0	0	0,0	11	0,6	11	1,2	22	0,7
Ceftazidime	0	0,0	0	0,0	9	0,5	11	1,2	20	0,6
Nalidixic acid	19	8,3	1	0,5	117	6,2	99	11,2	236	7,4
Ciprofloxacin	23	10,1	2	1,1	130	6,8	111	12,6	266	8,3
Ampicillin	78	34,2	34	18,1	507	26,7	390	44,2	1.009	31,5
Sulfamethoxazol	92	40,4	35	18,6	520	27,4	385	43,6	1.032	32,3
Trimethoprim	36	15,8	4	2,1	143	7,5	136	15,4	319	10,0
Tetracycline	70	30,7	37	19,7	484	25,5	381	43,1	972	30,4
Tested isolates (Number)	228		188		1901		883		3.200	

(1) Resistance to more than one class of antimicrobials

Tab. 20.8: Resistance rates of the 20 most frequent serovars from all origins (2009)

Antimicrobial tested	S. Anatum	S. Derby	S. Dublin	S. Enteritidis	S. Indiana	S. Infantis	S. Livingstone	S. London	S. Mbandaka	S. Montevideo	S. Newport	S. Ohio	S. Paratyphi B dT+	S. Saintpaul	S. Senftenberg	S. Subspec. I, rough	S. Tennessee	S. Typhimurium	S. 4,[5],12:i:-	S. Subspec. IIIa	S. Subspec. IIIb	S. Subspec. IV
Susceptible	60,5	62,7	96,2	91,2	64,3	55,0	85,7	71,4	88,2	78,6	50,0	88,6	14,3	5,9	90,7	41,4	100	40,4	4,4	100	81,3	77,4
Resistant	39,5	37,3	3,8	8,8	35,7	45,0	14,3	28,6	11,8	21,4	50,0	11,4	85,7	94,1	9,3	58,6	0,0	59,6	95,6	0,0	18,8	22,6
Multiresistant (1)	28,9	18,1	1,9	0,6	32,1	36,3	8,2	25,0	5,9	14,3	50,0	8,6	79,4	89,7	4,0	51,7	0,0	51,6	92,7	0,0	1,7	0,0
Gentamicin	0,0	1,2	0,0	0,0	0,0	0,0	2,0	7,1	0,0	14,3	0,0	2,9	4,8	54,4	0,0	9,2	0,0	1,4	1,0	0,0	0,0	0,0
Kanamycin	10,5	0,0	0,0	0,0	0,0	1,3	4,1	7,1	0,0	14,3	5,0	0,0	11,1	54,4	0,0	9,2	0,0	6,6	4,4	0,0	0,6	0,0
Streptomycin	21,1	14,5	0,0	0,6	21,4	17,5	4,1	14,3	0,0	14,3	0,0	2,9	19,0	61,8	1,3	33,3	0,0	48,1	92,5	0,0	11,9	17,7
Chloramphenicol	7,9	1,2	1,9	0,0	0,0	2,5	6,1	3,6	0,0	3,6	0,0	2,9	11,1	0,0	1,3	11,5	0,0	26,5	1,9	0,0	0,0	0,0
Florfenicol	2,6	0,0	0,0	0,0	0,0	0,0	2,0	3,6	0,0	0,0	0,0	0,0	0,0	0,0	0,0	3,4	0,0	22,7	1,0	0,0	0,0	0,0
Cefotaxime	0,0	0,0	0,0	0,0	0,0	3,8	0,0	3,6	0,0	0,0	0,0	0,0	11,1	1,5	1,3	0,0	0,0	0,3	1,0	0,0	0,0	0,0
Ceftazidime	0,0	0,0	0,0	0,0	0,0	3,8	0,0	0,0	0,0	0,0	0,0	0,0	11,1	0,0	1,3	0,0	0,0	0,3	1,0	0,0	0,0	0,0
Nalidixic acid	0,0	0,0	0,0	4,7	0,0	20,0	6,1	0,0	2,9	7,1	10,0	0,0	71,4	61,8	4,0	14,9	0,0	4,6	1,2	0,0	2,3	1,6
Ciprofloxacin	2,6	0,0	1,9	5,0	3,6	20,0	6,1	0,0	2,9	14,3	12,5	0,0	73,0	70,6	6,7	14,9	0,0	5,0	1,5	0,0	1,7	3,2
Ampicillin	15,8	12,0	1,9	3,8	25,0	15,0	6,1	17,9	5,9	7,1	45,0	5,7	33,3	79,4	1,3	40,2	0,0	50,3	92,0	0,0	0,6	0,0
Sulfamethoxazol	23,7	24,1	1,9	0,3	32,1	33,8	10,2	17,9	5,9	21,4	7,5	11,4	39,7	79,4	1,3	50,6	0,0	51,2	92,5	0,0	0,6	1,6
Trimethoprim	18,4	19,3	0,0	0,0	28,6	11,3	8,2	17,9	5,9	0,0	2,5	8,6	84,1	26,5	0,0	17,2	0,0	16,3	5,1	0,0	0,0	0,0
Tetracycline	10,5	21,7	1,9	0,3	32,1	22,5	6,1	17,9	8,8	10,7	47,5	2,9	28,6	47,1	0,0	46,0	0,0	48,0	86,7	0,0	5,1	0,0
Number of isolates	38	83	52	340	28	80	49	28	34	28	40	35	63	68	75	87	28	777	412	49	176	62

(1) Resistance to more than one class of antimicrobials

Tab. 20.9: Resistance rates of the 20 most frequent serovars from the environment (2009)

Antimicrobial tested	S. Anatum	S. Derby	S. Enteritidis	S. Give	S. Indiana	S. Infantis	S. Kottbus	S. Livingstone	S. Mbandaka	S. Monschaui	S. Montevideo	S. Ohio	S. ParatyphiB dT+	S. Saintpaul	S. Schwarzengrund	S. Senftenberg	S. Subspec. I, rough	S. Tennessee	S. Typhimurium	S. of group C1	S. 4,[5],12:i:-
Susceptible	80,0	60,0	95,5	50,0	100	54,5	100	90,9	75,0	1,0	0,0	100	0,0	0,0	100	100	25,0	100	36,2	2,0	0,0
Resistant	20,0	40,0	4,5	50,0	0,0	45,5	0,0	9,1	25,0	25,0	100	0,0	100	100	0,0	0,0	75,0	0,0	63,8	100	100
Multiresistant (1)	10,0	20,0	0,0	50,0	0,0	45,5	0,0	0,0	25,0	25,0	60,0	0,0	100	100	0,0	0,0	75,0	0,0	53,6	100	191
Gentamicin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	60,0	0,0	0,0	100	0,0	0,0	37,5	0,0	4,3	0,0	0,0
Kanamycin	20,0	0,0	0,0	0,0	0,0	9,1	0,0	0,0	0,0	0,0	60,0	0,0	22,2	100	0,0	0,0	50,0	0,0	8,7	0,0	8,7
Streptomycin	10,0	0,0	0,0	50,0	0,0	9,1	0,0	0,0	0,0	0,0	60,0	0,0	22,2	66,7	0,0	0,0	50,0	0,0	49,3	0,0	91,3
Chloramphenicol	10,0	0,0	0,0	0,0	0,0	9,1	0,0	0,0	0,0	0,0	20,0	0,0	11,1	0,0	0,0	0,0	0,0	0,0	15,9	0,0	0,0
Florfenicol	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	11,6	0,0	0,0
Cefotaxime	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Ceftazidime	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Nalidixic acid	0,0	0,0	4,5	0,0	0,0	9,1	0,0	0,0	0,0	0,0	20,0	0,0	100	100	0,0	0,0	37,5	0,0	1,4	0,0	0,0
Ciprofloxacin	0,0	0,0	4,5	50,0	0,0	9,1	0,0	0,0	0,0	50,0	60,0	0,0	100	100	0,0	0,0	37,5	0,0	1,4	0,0	0,0
Ampicillin	0,0	0,0	0,0	50,0	0,0	36,4	0,0	0,0	25,0	0,0	40,0	0,0	55,6	100	0,0	0,0	50,0	0,0	52,2	0,0	87,0
Sulfamethoxazol	10,0	40,0	0,0	50,0	0,0	45,5	0,0	9,1	25,0	0,0	100	0,0	77,8	100	0,0	0,0	75,0	0,0	53,6	0,0	91,3
Trimethoprim	0,0	20,0	0,0	50,0	0,0	27,3	0,0	9,1	25,0	0,0	0,0	0,0	100	0,0	0,0	0,0	25,0	0,0	23,2	0,0	4,3
Tetracycline	0,0	20,0	0,0	50,0	0,0	9,1	0,0	0,0	25,0	0,0	40,0	0,0	77,8	0,0	0,0	0,0	25,0	0,0	46,4	0,0	95,7
Number of isolates	10	5	22	2	3	11	4	11	4	2	5	2	9	3	3	7	8	3	69	2	23

(1) Resistance to more than one class of antimicrobials

Tab. 20.10: Resistance rates of the 20 most frequent serovars from feeding stuffs (2009)

Antimicrobial tested	S. Agona	S. Anatum	S. Brandenburg	S. Cerro	S. Falkensee	S. Havana	S. Idikan	S. Infantis	S. Livingstone	S. London	S. Mbandaka	S. Montevideo	S. Ohio	S. Orion	S. Schwarzengrund	S. Senftenberg	S. Subspec. I, rough	S. Tennessee	S. Typhimurium	S. 4,[5],12:i:-
Susceptible	100	75,0	100	100	100	100	100	100	100	66,7	100	100	90,9	100	100	100	100	100	29,4	0,0
Resistant	0,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	33,3	0,0	0,0	9,1	0,0	0,0	0,0	0,0	0,0	70,6	100
Multiresistant (1)	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	70,6	100
Gentamicin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	11,8	0,0
Kanamycin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	5,9	0,0
Streptomycin	0,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	64,7	100
Chloramphenicol	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	23,5	0,0
Florfenicol	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	11,8	0,0
Cefotaxime	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Ceftazidime	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Nalidixic acid	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Ciprofloxacin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Ampicillin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	64,7	100
Sulfamethoxazol	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	33,3	0,0	0,0	9,1	0,0	0,0	0,0	0,0	0,0	64,7	100
Trimethoprim	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	33,3	0,0	0,0	9,1	0,0	0,0	0,0	0,0	0,0	5,9	0,0
Tetracycline	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	70,6	94,7
Number of isolates	5	4	3	4	7	6	3	5	12	3	5	10	11	4	3	13	4	7	17	19

(1) Resistance to more than one class of antimicrobials

Tab. 20.11: Resistance rates of the 20 most frequent serovars from animals (2009)

Antimicrobial tested	S. Derby	S. Dublin	S. Enteritidis	S. Indiana	S. Infantis	S. Kisarawe	S. Livingstone	S. Mbandaka	S. ParatyphiB dT+	S. Saintpaul	S. Senftenberg	S. Subspec. I, rough	S. Tennessee	S. Typhimurium	S. Virchow	S. 4,[5],12:i:-	S. Subspec. II	S. Subspec. IIIa	S. Subspec. IIIb	S. Subspec. IV
Susceptible	60,0	95,1	95,3	50,0	62,5	15,0	77,8	85,0	50,0	2,6	72,2	57,1	100	48,0	31,3	4,2	20,0	100	81,1	77,4
Resistant	40,0	4,9	4,7	50,0	37,5	1,0	22,2	15,0	50,0	97,4	27,8	42,9	0,0	52,0	68,8	95,8	1,0	0,0	18,9	22,6
Multiresistant (1)	36,0	2,4	0,9	43,8	25,0	0,0	11,1	5,0	43,8	94,9	16,7	38,1	0,0	42,7	6,3	94,3	0,0	0,0	1,7	0,0
Gentamicin	4,0	0,0	0,0	0,0	0,0	0,0	5,6	0,0	0,0	61,5	0,0	9,5	0,0	1,0	0,0	1,9	0,0	0,0	0,0	0,0
Kanamycin	0,0	0,0	0,0	0,0	0,0	0,0	5,6	0,0	6,3	61,5	0,0	7,1	0,0	6,7	0,0	4,2	0,0	0,0	0,6	0,0
Streptomycin	32,0	0,0	0,9	31,3	20,8	0,0	5,6	0,0	6,3	64,1	5,6	14,3	0,0	42,9	0,0	94,3	4,8	0,0	12,0	17,7
Chloramphenicol	0,0	2,4	0,0	0,0	0,0	0,0	5,6	0,0	0,0	0,0	5,6	7,1	0,0	24,5	0,0	3,3	0,0	0,0	0,0	0,0
Florfenicol	0,0	0,0	0,0	0,0	0,0	0,0	5,6	0,0	0,0	0,0	0,0	2,4	0,0	21,1	0,0	1,9	0,0	0,0	0,0	0,0
Cefotaxime	0,0	0,0	0,0	0,0	4,2	0,0	0,0	0,0	0,0	2,6	5,6	0,0	0,0	0,4	0,0	1,9	0,0	0,0	0,0	0,0
Ceftazidime	0,0	0,0	0,0	0,0	4,2	0,0	0,0	0,0	0,0	0,0	5,6	0,0	0,0	0,4	0,0	1,9	0,0	0,0	0,0	0,0
Nalidixic acid	0,0	0,0	2,8	0,0	8,3	6,3	16,7	5,0	37,5	69,2	5,6	23,8	0,0	4,5	68,8	2,4	0,0	0,0	2,3	1,6
Ciprofloxacin	0,0	2,4	2,8	0,0	8,3	6,3	16,7	5,0	37,5	69,2	16,7	23,8	0,0	5,1	68,8	2,8	0,0	0,0	1,7	3,2
Ampicillin	24,0	2,4	1,9	37,5	16,7	0,0	11,1	5,0	6,3	79,5	5,6	16,7	0,0	41,1	6,3	93,9	0,0	0,0	0,6	0,0
Sulfamethoxazol	36,0	2,4	0,5	43,8	20,8	0,0	11,1	5,0	6,3	92,3	5,6	35,7	0,0	42,7	6,3	93,9	0,0	0,0	0,6	1,6
Trimethoprim	24,0	0,0	0,0	37,5	16,7	0,0	5,6	5,0	43,8	33,3	0,0	4,8	0,0	13,4	6,3	6,6	0,0	0,0	0,0	0,0
Tetracycline	32,0	2,4	0,5	43,8	12,5	0,0	5,6	10,0	12,5	51,3	0,0	35,7	0,0	39,3	6,3	86,3	0,0	0,0	5,1	0,0
Number of isolates	25	41	212	16	24	16	18	20	16	39	18	42	17	506	16	212	21	49	175	62

(1) Resistance to more than one class of antimicrobials

Tab. 20.12: Resistance rates of the 20 most frequent serovars from foodstuffs (2009)

Antimicrobial tested	S. Anatum	S. Bovismorbificans	S. Brandenburg	S. Derby	S. Dublin	S. Enteritidis	S. Hadar	S. Indiana	S. Infantis	S. Livingstone	S. London	S. Newport	S. Ohio	S. ParatyphiBdT+	S. Saintpaul	S. Senftenberg	S. Subspec. I, rough	S. Typhimurium	S. 4,12:d:-	S. 4,[5],12:i:-
Susceptible	50,0	0,0	77,8	65,4	100,0	81,9	0,0	77,8	45,0	75,0	90,9	28,0	88,9	2,6	11,5	94,6	18,2	22,2	100,0	5,7
Resistant	50,0	100,0	22,2	34,6	0,0	18,1	100,0	22,2	55,0	25,0	9,1	72,0	11,1	97,4	88,5	5,4	81,8	77,8	0,0	94,3
Multiresistant (1)	40,0	100,0	11,1	9,6	0,0	0,0	88,9	22,2	45,0	25,0	9,1	72,0	11,1	89,5	80,8	0,0	69,7	73,5	0,0	89,9
Gentamicin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	7,9	38,5	0,0	3,0	0,5	0,0	0,0
Kanamycin	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	12,5	0,0	8,0	0,0	10,5	38,5	0,0	3,0	5,4	0,0	4,4
Streptomycin	10,0	0,0	22,2	7,7	0,0	0,0	66,7	11,1	20,0	12,5	0,0	0,0	0,0	23,7	57,7	0,0	57,6	60,5	0,0	89,2
Chloramphenicol	10,0	0,0	11,1	1,9	0,0	0,0	11,1	0,0	2,5	25,0	0,0	0,0	11,1	15,8	0,0	0,0	21,2	36,2	0,0	0,6
Florfenicol	0,0	0,0	11,1	0,0	0,0	0,0	11,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	6,1	31,9	0,0	0,0
Cefotaxime	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	5,0	0,0	0,0	0,0	0,0	18,4	0,0	0,0	0,0	0,0	0,0	0,0
Ceftazidime	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	5,0	0,0	0,0	0,0	0,0	18,4	0,0	0,0	0,0	0,0	0,0	0,0
Nalidixic acid	0,0	14,3	0,0	0,0	0,0	8,6	44,4	0,0	32,5	0,0	0,0	16,0	0,0	78,9	46,2	5,4	0,0	6,5	0,0	0,0
Ciprofloxacin	10,0	14,3	0,0	0,0	0,0	9,5	55,6	11,1	32,5	0,0	0,0	20,0	0,0	81,6	69,2	5,4	0,0	6,5	0,0	0,0
Ampicillin	10,0	100,0	0,0	7,7	0,0	8,6	11,1	11,1	10,0	12,5	9,1	64,0	11,1	39,5	76,9	0,0	72,7	73,5	0,0	89,2
Sulfamethoxazol	20,0	100,0	11,1	17,3	0,0	0,0	22,2	22,2	42,5	25,0	9,1	12,0	11,1	44,7	57,7	0,0	69,7	72,4	0,0	89,9
Trimethoprim	10,0	100,0	0,0	17,3	0,0	0,0	22,2	22,2	5,0	25,0	9,1	4,0	0,0	97,4	19,2	0,0	33,3	22,7	0,0	3,8
Tetracycline	20,0	100,0	0,0	15,4	0,0	0,0	100,0	22,2	35,0	25,0	9,1	68,0	0,0	23,7	46,2	0,0	69,7	70,3	0,0	84,8
Number of isolates	10	7	9	52	11	105	9	9	40	8	11	25	9	38	26	37	33	185	8	158

(1) Resistance to more than one class of antimicrobials

20.1.3 Distribution of MIC values in Salmonella isolates

20.1.3.1 Isolates from all origins

Tab. 20.13: *Salmonella* spp. from all origins (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	3200	74	2,3						77,0	19,1	1,4	0,2	0,1	1,0	0,8	0,3	0,1					
Kanamycin	3200	143	4,5										94,7	0,9	0,2	0,8	0,2	0,1	3,2			
Streptomycin	3200	963	30,1									7,5	11,7	24,6	16,3	9,8	7,9	7,4	14,8			
Chloramphenicol	3200	250	7,8									2,9	37,8	49,8	1,8	0,1	0,2	7,5				
Florfenicol	3200	189	5,9									8,4	63,4	20,4	2,0	2,5	2,3	1,1				
Cefotaxime	3200	22	0,7				42,8	44,0	11,4	1,1	0,0	0,0	0,0	0,7								
Ceftazidime	3200	20	0,6						60,8	32,4	5,8	0,4	0,2	0,3	0,0	0,2						
Nalidixic acid	3200	236	7,4										89,3	2,7	0,6	0,2	0,7	6,6				
Ciprofloxacin	3200	266	8,3	1,3	16,9	64,4	9,1	0,5	3,2	2,8	1,3	0,4	0,0	0,0	0,0							
Ampicillin	3200	1009	31,5							6,3	45,2	15,9	1,2	0,1	0,0	0,0	31,4					
Colistin (1)	3200													100,0	0,0	0,0						
Sulfamethoxazole	3200	1032	32,3											3,7	4,8	15,4	37,1	6,4	0,4	0,0	0,2	32,0
Trimethoprim	3200	319	10,0							88,3	1,6	0,1	0,0	0,0	0,0	0,0	9,9					
Tetracycline	3200	972	30,4								14,5	49,8	5,2	0,1	0,2	4,0	3,3	22,9				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

20.1.3.2 Isolates from the environment

Tab. 20.14: *Salmonella* spp. from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	228	12	5,3						76,3	15,4	3,1	0,0	0,0	2,6	0,4	1,8	0,4					
Kanamycin	228	23	10,1										89,5	0,4	0,4	2,2	0,9	0,4	6,1			
Streptomycin	228	73	32,0									5,7	11,4	24,1	17,5	9,2	7,9	5,7	18,4			
Chloramphenicol	228	15	6,6									2,2	33,8	54,4	3,1	0,4	0,0	6,1				
Florfenicol	228	8	3,5									4,4	64,5	23,7	3,9	1,8	0,9	0,9				
Cefotaxime	228	0	0,0				36,0	43,9	18,0	2,2	0,0	0,0	0,0	0,0								
Ceftazidime	228	0	0,0						50,9	36,4	11,4	1,3	0,0	0,0	0,0	0,0						
Nalidixic acid	228	19	8,3										86,0	4,8	0,9	0,4	0,4	7,5				
Ciprofloxacin	228	23	10,1	0,4	13,2	64,0	12,3	0,0	0,9	4,8	3,9	0,4	0,0	0,0	0,0							
Ampicillin	228	78	34,2							2,2	39,9	21,5	2,2	0,9	0,0	0,0	33,3					
Colistin (1)	228													100,0	0,0	0,0						
Sulfamethoxazole	228	92	40,4											3,5	1,8	9,6	36,8	7,9	0,0	0,0	1,3	39,0
Trimethoprim	228	36	15,8							82,9	1,3	0,0	0,0	0,0	0,0	0,0	15,8					
Tetracycline	228	70	30,7								7,5	52,2	8,8	0,9	0,4	3,5	2,6	24,1				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.15: *S.* 4,[5],12:i:- from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	23	0	0,0						56,5	34,8	8,7	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	23	2	8,7										91,3	0,0	0,0	0,0	0,0	0,0	8,7			
Streptomycin	23	21	91,3									0,0	0,0	8,7	0,0	0,0	0,0	13,0	78,3			
Chloramphenicol	23	0	0,0									0,0	39,1	60,9	0,0	0,0	0,0	0,0				
Florfenicol	23	0	0,0									0,0	82,6	17,4	0,0	0,0	0,0	0,0				
Cefotaxime	23	0	0,0				43,5	34,8	21,7	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	23	0	0,0						60,9	26,1	13,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	23	0	0,0										87,0	13,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	23	0	0,0	0,0	0,0	82,6	17,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	23	20	87,0							0,0	13,0	0,0	0,0	0,0	0,0	0,0	87,0					
Colistin (1)	23													100,0	0,0	0,0						
Sulfamethoxazole	23	21	91,3											0,0	0,0	0,0	8,7	0,0	0,0	0,0	0,0	91,3
Trimethoprim	23	1	4,3							95,7	0,0	0,0	0,0	0,0	0,0	0,0	4,3					
Tetracycline	23	22	95,7								0,0	4,3	0,0	0,0	0,0	0,0	0,0	95,7				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.16: *S.* Anatum from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	10	0	0,0						90,0	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	10	2	20,0										80,0	0,0	0,0	0,0	0,0	0,0	20,0			
Streptomycin	10	1	10,0									0,0	0,0	40,0	40,0	10,0	10,0	0,0	0,0			
Chloramphenicol	10	1	10,0									0,0	10,0	70,0	10,0	0,0	0,0	10,0				
Florfenicol	10	0	0,0									0,0	80,0	0,0	20,0	0,0	0,0	0,0				
Cefotaxime	10	0	0,0				0,0	80,0	20,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	10	0	0,0						0,0	70,0	30,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	10	0	0,0										90,0	10,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	10	0	0,0	0,0	10,0	80,0	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	10	0	0,0							0,0	70,0	30,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	10													100,0	0,0	0,0						
Sulfamethoxazole	10	1	10,0											0,0	0,0	10,0	40,0	40,0	0,0	0,0	0,0	10,0
Trimethoprim	10	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	10	0	0,0								10,0	60,0	30,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.17: *S.* Derby from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	0	0,0						80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	5	0	0,0									0,0	0,0	60,0	20,0	20,0	0,0	0,0	0,0			
Chloramphenicol	5	0	0,0									0,0	20,0	80,0	0,0	0,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	20,0	80,0	0,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				0,0	60,0	40,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	5	0	0,0	0,0	60,0	40,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	5	0	0,0							20,0	60,0	20,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	2	40,0											0,0	0,0	20,0	40,0	0,0	0,0	0,0	0,0	40,0
Trimethoprim	5	1	20,0							80,0	0,0	0,0	0,0	0,0	0,0	0,0	20,0					
Tetracycline	5	1	20,0								20,0	60,0	0,0	0,0	0,0	0,0	0,0	20,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.18: *S.* Enteritidis from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	22	0	0,0						81,8	18,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	22	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	22	0	0,0									50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	22	0	0,0									0,0	54,5	45,5	0,0	0,0	0,0	0,0				
Florfenicol	22	0	0,0									0,0	90,9	9,1	0,0	0,0	0,0	0,0				
Cefotaxime	22	0	0,0				68,2	22,7	9,1	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	22	0	0,0						81,8	18,2	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	22	1	4,5										90,9	4,5	0,0	0,0	0,0	4,5				
Ciprofloxacin	22	1	4,5	0,0	4,5	90,9	0,0	0,0	0,0	4,5	0,0	0,0	0,0	0,0	0,0							
Ampicillin	22	0	0,0							0,0	77,3	22,7	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	22													100,0	0,0	0,0						
Sulfamethoxazole	22	0	0,0											4,5	0,0	9,1	86,4	0,0	0,0	0,0	0,0	0,0
Trimethoprim	22	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	22	0	0,0								13,6	86,4	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.19: *S.* Infantis from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	11	0	0,0						90,9	0,0	9,1	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	11	1	9,1										90,9	0,0	0,0	0,0	0,0	0,0	9,1			
Streptomycin	11	1	9,1									0,0	0,0	36,4	27,3	27,3	0,0	0,0	9,1			
Chloramphenicol	11	1	9,1									0,0	27,3	63,6	0,0	0,0	0,0	9,1				
Florfenicol	11	0	0,0									0,0	45,5	45,5	9,1	0,0	0,0	0,0				
Cefotaxime	11	0	0,0				18,2	45,5	36,4	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	11	0	0,0						18,2	45,5	36,4	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	11	1	9,1										90,9	0,0	0,0	0,0	0,0	9,1				
Ciprofloxacin	11	1	9,1	0,0	9,1	63,6	18,2	0,0	0,0	9,1	0,0	0,0	0,0	0,0	0,0							
Ampicillin	11	4	36,4							0,0	54,5	9,1	0,0	0,0	0,0	0,0	36,4					
Colistin (1)	11													100,0	0,0	0,0						
Sulfamethoxazole	11	5	45,5											0,0	0,0	36,4	18,2	0,0	0,0	0,0	0,0	45,5
Trimethoprim	11	3	27,3							72,7	0,0	0,0	0,0	0,0	0,0	0,0	27,3					
Tetracycline	11	1	9,1								9,1	72,7	9,1	0,0	0,0	0,0	9,1	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.20: *S.* Livingstone from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	11	0	0,0						63,6	27,3	9,1	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	11	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	11	0	0,0									0,0	18,2	63,6	9,1	9,1	0,0	0,0	0,0			
Chloramphenicol	11	0	0,0									0,0	54,5	45,5	0,0	0,0	0,0	0,0				
Florfenicol	11	0	0,0									0,0	90,9	9,1	0,0	0,0	0,0	0,0				
Cefotaxime	11	0	0,0				27,3	36,4	36,4	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	11	0	0,0						36,4	54,5	9,1	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	11	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	11	0	0,0	0,0	0,0	45,5	54,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	11	0	0,0							0,0	36,4	63,6	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	11													100,0	0,0	0,0						
Sulfamethoxazole	11	1	9,1											0,0	0,0	0,0	90,9	0,0	0,0	0,0	0,0	9,1
Trimethoprim	11	1	9,1							90,9	0,0	0,0	0,0	0,0	0,0	0,0	9,1					
Tetracycline	11	0	0,0								0,0	54,5	36,4	9,1	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.21: *S.* Montevideo from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3) 0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	3	60,0						20,0	20,0	0,0	0,0	0,0	0,0	0,0	40,0	20,0					
Kanamycin	5	3	60,0										40,0	0,0	20,0	0,0	20,0	20,0	0,0			
Streptomycin	5	3	60,0									0,0	0,0	0,0	40,0	0,0	0,0	20,0	40,0			
Chloramphenicol	5	1	20,0									0,0	40,0	40,0	0,0	20,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	40,0	40,0	20,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				0,0	40,0	20,0	40,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						0,0	60,0	20,0	20,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	1	20,0										40,0	40,0	0,0	20,0	0,0	0,0				
Ciprofloxacin	5	3	60,0	0,0	0,0	20,0	20,0	0,0	0,0	20,0	40,0	0,0	0,0	0,0	0,0							
Ampicillin	5	2	40,0							0,0	0,0	40,0	20,0	40,0	0,0	0,0	0,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	5	100,0											0,0	0,0	0,0	0,0	0,0	0,0	0,0	20,0	80,0
Trimethoprim	5	0	0,0							60,0	40,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	5	2	40,0								0,0	40,0	0,0	20,0	0,0	0,0	0,0	40,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.22: *S.* Paratyphi B dT+ from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3) 0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	9	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	9	2	22,2										77,8	0,0	0,0	0,0	0,0	0,0	22,2			
Streptomycin	9	2	22,2									0,0	0,0	0,0	22,2	55,6	22,2	0,0	0,0			
Chloramphenicol	9	1	11,1									0,0	44,4	44,4	0,0	0,0	0,0	11,1				
Florfenicol	9	0	0,0									11,1	66,7	22,2	0,0	0,0	0,0	0,0				
Cefotaxime	9	0	0,0				0,0	44,4	44,4	11,1	0,0	0,0	0,0	0,0								
Ceftazidime	9	0	0,0						22,2	44,4	33,3	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	9	9	100,0										0,0	0,0	0,0	0,0	11,1	88,9				
Ciprofloxacin	9	9	100,0	0,0	0,0	0,0	0,0	0,0	11,1	77,8	11,1	0,0	0,0	0,0	0,0							
Ampicillin	9	5	55,6							0,0	0,0	33,3	11,1	0,0	0,0	0,0	55,6					
Colistin (1)	9													100,0	0,0	0,0						
Sulfamethoxazole	9	7	77,8											0,0	11,1	0,0	11,1	0,0	0,0	0,0	11,1	66,7
Trimethoprim	9	9	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Tetracycline	9	7	77,8								11,1	0,0	11,1	0,0	0,0	0,0	0,0	77,8				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.23: *S.* Senftenberg from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	7	0	0,0						85,7	14,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	7	0	0,0									14,3	57,1	14,3	0,0	14,3	0,0	0,0	0,0			
Chloramphenicol	7	0	0,0									0,0	71,4	28,6	0,0	0,0	0,0	0,0				
Florfenicol	7	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	7	0	0,0				28,6	42,9	28,6	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	7	0	0,0						28,6	28,6	42,9	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	7	0	0,0	0,0	57,1	42,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	7	0	0,0							14,3	28,6	42,9	14,3	0,0	0,0	0,0	0,0					
Colistin (1)	7													100,0	0,0	0,0						
Sulfamethoxazole	7	0	0,0											0,0	14,3	42,9	42,9	0,0	0,0	0,0	0,0	0,0
Trimethoprim	7	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	7	0	0,0								28,6	71,4	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.24: *S.* Subspec. I rough from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	8	3	37,5						50,0	12,5	0,0	0,0	0,0	37,5	0,0	0,0	0,0					
Kanamycin	8	4	50,0										50,0	0,0	0,0	25,0	12,5	0,0	12,5			
Streptomycin	8	4	50,0									12,5	0,0	25,0	0,0	12,5	37,5	0,0	12,5			
Chloramphenicol	8	0	0,0									12,5	25,0	50,0	12,5	0,0	0,0	0,0				
Florfenicol	8	0	0,0									25,0	25,0	50,0	0,0	0,0	0,0	0,0				
Cefotaxime	8	0	0,0				12,5	37,5	50,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	8	0	0,0						12,5	50,0	12,5	25,0	0,0	0,0	0,0	0,0						
Nalidixic acid	8	3	37,5										62,5	0,0	0,0	0,0	0,0	37,5				
Ciprofloxacin	8	3	37,5	0,0	0,0	62,5	0,0	0,0	0,0	0,0	37,5	0,0	0,0	0,0	0,0							
Ampicillin	8	4	50,0							0,0	25,0	25,0	0,0	0,0	0,0	0,0	50,0					
Colistin (1)	8													100,0	0,0	0,0						
Sulfamethoxazole	8	6	75,0											0,0	0,0	25,0	0,0	0,0	0,0	0,0	0,0	75,0
Trimethoprim	8	2	25,0							75,0	0,0	0,0	0,0	0,0	0,0	0,0	25,0					
Tetracycline	8	2	25,0								25,0	37,5	12,5	0,0	0,0	0,0	12,5	12,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.25: *S.* Typhimurium from the environment (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	69	3	4,3						76,8	17,4	1,4	0,0	0,0	0,0	1,4	2,9	0,0					
Kanamycin	69	6	8,7										89,9	1,4	0,0	0,0	0,0	0,0	8,7			
Streptomycin	69	34	49,3									0,0	5,8	18,8	17,4	8,7	11,6	11,6	26,1			
Chloramphenicol	69	11	15,9									4,3	20,3	58,0	1,4	0,0	0,0	15,9				
Florfenicol	69	8	11,6									7,2	56,5	23,2	1,4	5,8	2,9	2,9				
Cefotaxime	69	0	0,0				47,8	44,9	5,8	1,4	0,0	0,0	0,0	0,0								
Ceftazidime	69	0	0,0						72,5	26,1	1,4	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	69	1	1,4										97,1	1,4	0,0	0,0	0,0	1,4				
Ciprofloxacin	69	1	1,4	0,0	15,9	69,6	13,0	0,0	1,4	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	69	36	52,2							0,0	31,9	13,0	2,9	0,0	0,0	0,0	52,2					
Colistin (1)	69													100,0	0,0	0,0						
Sulfamethoxazole	69	37	53,6											1,4	0,0	7,2	30,4	7,2	0,0	0,0	1,4	52,2
Trimethoprim	69	16	23,2							76,8	0,0	0,0	0,0	0,0	0,0	0,0	23,2					
Tetracycline	69	32	46,4								2,9	47,8	2,9	0,0	1,4	11,6	5,8	27,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

20.1.3.3 Isolates from feeding stuffs

Tab. 20.26: *Salmonella* spp. from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	188	2	1,1						81,4	16,5	1,1	0,0	0,0	0,5	0,5	0,0	0,0					
Kanamycin	188	1	0,5										98,9	0,5	0,0	0,0	0,0	0,0	0,5			
Streptomycin	188	35	18,6									2,7	13,8	44,7	17,0	3,2	1,1	6,4	11,2			
Chloramphenicol	188	5	2,7									1,1	16,0	80,3	0,0	0,0	0,0	2,7				
Florfenicol	188	3	1,6									2,1	63,3	33,0	0,0	1,1	0,5	0,0				
Cefotaxime	188	0	0,0				44,7	49,5	5,3	0,5	0,0	0,0	0,0	0,0								
Ceftazidime	188	0	0,0						60,1	36,7	3,2	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	188	1	0,5										98,9	0,0	0,5	0,0	0,0	0,5				
Ciprofloxacin	188	2	1,1	1,1	27,1	67,0	3,7	0,0	0,0	1,1	0,0	0,0	0,0	0,0	0,0							
Ampicillin	188	34	18,1							8,0	68,6	5,3	0,0	0,0	0,0	0,0	18,1					
Colistin (1)	188													100,0	0,0	0,0						
Sulfamethoxazole	188	35	18,6											1,1	4,3	18,1	51,6	6,4	0,0	0,0	0,0	18,6
Trimethoprim	188	4	2,1							96,8	0,5	0,5	0,0	0,0	0,0	0,0	2,1					
Tetracycline	188	37	19,7								11,2	67,6	1,6	0,0	0,0	1,1	0,5	18,1				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.27: *S.* 4,12:d:- from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																	
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	19	0	0,0						89,5	10,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0				
Kanamycin	19	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0		
Streptomycin	19	19	100,0									0,0	0,0	0,0	0,0	0,0	0,0	36,8	63,2		
Chloramphenicol	19	0	0,0									0,0	10,5	89,5	0,0	0,0	0,0	0,0			
Florfenicol	19	0	0,0									0,0	52,6	47,4	0,0	0,0	0,0	0,0			
Cefotaxime	19	0	0,0				57,9	42,1	0,0	0,0	0,0	0,0	0,0	0,0							
Ceftazidime	19	0	0,0						78,9	21,1	0,0	0,0	0,0	0,0	0,0	0,0					
Nalidixic acid	19	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0			
Ciprofloxacin	19	0	0,0	0,0	0,0	89,5	10,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Ampicillin	19	19	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0				
Colistin (1)	19													100,0	0,0	0,0					
Sulfamethoxazole	19	19	100,0											0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	19	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0				
Tetracycline	19	18	94,7								0,0	5,3	0,0	0,0	0,0	0,0	0,0	94,7			

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.28: *S.* Agona from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	5	0	0,0									0,0	0,0	60,0	40,0	0,0	0,0	0,0	0,0			
Chloramphenicol	5	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	20,0	80,0	0,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				20,0	80,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						60,0	40,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	5	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	5	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	0	0,0											0,0	0,0	0,0	80,0	20,0	0,0	0,0	0,0	0,0
Trimethoprim	5	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	5	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MIC s below the tested range.

Tab. 20.29: *S.* Falkensee from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	7	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	7	0	0,0									0,0	14,3	71,4	14,3	0,0	0,0	0,0	0,0			
Chloramphenicol	7	0	0,0									0,0	14,3	85,7	0,0	0,0	0,0	0,0				
Florfenicol	7	0	0,0									14,3	85,7	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	7	0	0,0				14,3	85,7	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	7	0	0,0						57,1	42,9	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	7	0	0,0	0,0	57,1	42,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	7	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	7													100,0	0,0	0,0						
Sulfamethoxazole	7	0	0,0											0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	7	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	7	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.30: *S.* Havana from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	6	0	0,0						66,7	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	6	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	6	0	0,0									33,3	50,0	0,0	16,7	0,0	0,0	0,0	0,0			
Chloramphenicol	6	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	6	0	0,0									0,0	16,7	83,3	0,0	0,0	0,0	0,0				
Cefotaxime	6	0	0,0				50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	6	0	0,0						66,7	33,3	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	6	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	6	0	0,0	0,0	16,7	83,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	6	0	0,0							16,7	83,3	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	6													100,0	0,0	0,0						
Sulfamethoxazole	6	0	0,0											0,0	33,3	33,3	33,3	0,0	0,0	0,0	0,0	0,0
Trimethoprim	6	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	6	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.31: *S.* Infantis from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	5	0	0,0									0,0	0,0	60,0	20,0	20,0	0,0	0,0	0,0			
Chloramphenicol	5	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	20,0	80,0	0,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						20,0	80,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	5	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	5	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	0	0,0											0,0	0,0	20,0	80,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	5	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	5	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.32: *S.* Livingstone from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	12	0	0,0						66,7	25,0	8,3	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	12	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	12	0	0,0									0,0	16,7	50,0	33,3	0,0	0,0	0,0	0,0			
Chloramphenicol	12	0	0,0									0,0	16,7	83,3	0,0	0,0	0,0	0,0				
Florfenicol	12	0	0,0									0,0	75,0	25,0	0,0	0,0	0,0	0,0				
Cefotaxime	12	0	0,0				41,7	41,7	16,7	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	12	0	0,0						58,3	41,7	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	12	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	12	0	0,0	0,0	16,7	83,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	12	0	0,0							8,3	91,7	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	12													100,0	0,0	0,0						
Sulfamethoxazole	12	0	0,0											0,0	0,0	25,0	75,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	12	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	12	0	0,0								8,3	91,7	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.33: *S.* Mbandaka from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	0	0,0						60,0	40,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	5	0	0,0									0,0	0,0	60,0	40,0	0,0	0,0	0,0	0,0			
Chloramphenicol	5	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	60,0	40,0	0,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				20,0	60,0	20,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						20,0	80,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	5	0	0,0	0,0	60,0	40,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	5	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	0	0,0											0,0	0,0	0,0	40,0	60,0	0,0	0,0	0,0	0,0
Trimethoprim	5	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	5	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.34: *S.* Montevideo from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	10	0	0,0						90,0	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	10	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	10	0	0,0									0,0	10,0	70,0	20,0	0,0	0,0	0,0	0,0			
Chloramphenicol	10	0	0,0									0,0	20,0	80,0	0,0	0,0	0,0	0,0				
Florfenicol	10	0	0,0									0,0	70,0	30,0	0,0	0,0	0,0	0,0				
Cefotaxime	10	0	0,0				100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	10	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	10	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	10	0	0,0	0,0	10,0	90,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	10	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	10													100,0	0,0	0,0						
Sulfamethoxazole	10	0	0,0											0,0	0,0	20,0	70,0	10,0	0,0	0,0	0,0	0,0
Trimethoprim	10	0	0,0							90,0	10,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	10	0	0,0								10,0	90,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.35: *S.* Ohio from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	11	0	0,0						81,8	18,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	11	0	0,0										90,9	9,1	0,0	0,0	0,0	0,0	0,0			
Streptomycin	11	0	0,0									0,0	63,6	36,4	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	11	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	11	0	0,0									0,0	45,5	54,5	0,0	0,0	0,0	0,0				
Cefotaxime	11	0	0,0				36,4	63,6	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	11	0	0,0						36,4	63,6	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	11	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	11	0	0,0	0,0	45,5	54,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	11	0	0,0							36,4	54,5	9,1	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	11													100,0	0,0	0,0						
Sulfamethoxazole	11	1	9,1											0,0	0,0	0,0	90,9	0,0	0,0	0,0	0,0	9,1
Trimethoprim	11	1	9,1							90,9	0,0	0,0	0,0	0,0	0,0	0,0	9,1					
Tetracycline	11	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.36: *S.* Senftenberg from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	13	0	0,0						92,3	7,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	13	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	13	0	0,0									0,0	0,0	84,6	15,4	0,0	0,0	0,0	0,0			
Chloramphenicol	13	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	13	0	0,0									0,0	53,8	46,2	0,0	0,0	0,0	0,0				
Cefotaxime	13	0	0,0				0,0	84,6	15,4	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	13	0	0,0						38,5	53,8	7,7	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	13	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	13	0	0,0	0,0	23,1	76,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	13	0	0,0							0,0	84,6	15,4	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	13													100,0	0,0	0,0						
Sulfamethoxazole	13	0	0,0											7,7	0,0	30,8	46,2	15,4	0,0	0,0	0,0	0,0
Trimethoprim	13	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	13	0	0,0								23,1	69,2	7,7	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.37: *S.* Tennessee from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	7	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	7	0	0,0									0,0	0,0	28,6	42,9	28,6	0,0	0,0	0,0			
Chloramphenicol	7	0	0,0									0,0	14,3	85,7	0,0	0,0	0,0	0,0				
Florfenicol	7	0	0,0									0,0	71,4	28,6	0,0	0,0	0,0	0,0				
Cefotaxime	7	0	0,0				42,9	28,6	28,6	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	7	0	0,0						42,9	42,9	14,3	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	7	0	0,0	0,0	57,1	42,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	7	0	0,0							14,3	85,7	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	7													100,0	0,0	0,0						
Sulfamethoxazole	7	0	0,0											0,0	0,0	14,3	57,1	28,6	0,0	0,0	0,0	0,0
Trimethoprim	7	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	7	0	0,0								0,0	85,7	14,3	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.38: *S.* Typhimurium from feeding stuffs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	17	2	11,8						76,5	11,8	0,0	0,0	0,0	5,9	5,9	0,0	0,0					
Kanamycin	17	1	5,9										94,1	0,0	0,0	0,0	0,0	0,0	5,9			
Streptomycin	17	11	64,7									0,0	0,0	23,5	11,8	0,0	0,0	17,6	47,1			
Chloramphenicol	17	4	23,5									11,8	11,8	52,9	0,0	0,0	0,0	23,5				
Florfenicol	17	2	11,8									11,8	64,7	11,8	0,0	5,9	5,9	0,0				
Cefotaxime	17	0	0,0				41,2	58,8	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	17	0	0,0						58,8	35,3	5,9	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	17	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	17	0	0,0	11,8	0,0	82,4	5,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	17	11	64,7							11,8	17,6	5,9	0,0	0,0	0,0	0,0	64,7					
Colistin (1)	17													100,0	0,0	0,0						
Sulfamethoxazole	17	11	64,7											0,0	5,9	0,0	29,4	0,0	0,0	0,0	0,0	64,7
Trimethoprim	17	1	5,9							94,1	0,0	0,0	0,0	0,0	0,0	0,0	5,9					
Tetracycline	17	12	70,6								11,8	17,6	0,0	0,0	0,0	5,9	0,0	64,7				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.1.3.4 Isolates from animals

Tab. 20.39: *Salmonella* spp. from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1901	44	2,3						77,3	18,9	1,3	0,2	0,1	1,1	0,8	0,2	0,1					
Kanamycin	1901	79	4,2										94,7	1,2	0,1	0,8	0,1	0,1	3,1			
Streptomycin	1901	530	27,9									8,7	12,7	22,0	17,4	11,3	8,7	7,0	12,2			
Chloramphenicol	1901	141	7,4									3,8	42,5	44,8	1,5	0,1	0,1	7,3				
Florfenicol	1901	115	6,0									11,3	63,8	17,3	1,6	2,2	2,3	1,6				
Cefotaxime	1901	11	0,6				47,8	41,7	9,2	0,7	0,1	0,0	0,0	0,5								
Ceftazidime	1901	9	0,5						66,5	28,2	4,5	0,3	0,2	0,2	0,0	0,1						
Nalidixic acid	1901	117	6,2										90,8	2,6	0,4	0,1	0,6	5,5				
Ciprofloxacin	1901	130	6,8	1,8	19,7	62,8	8,9	0,6	2,9	1,9	0,9	0,4	0,0	0,0	0,0							
Ampicillin	1901	507	26,7							8,0	48,0	16,3	1,1	0,1	0,0	0,0	26,6					
Colistin (1)	1901													99,9	0,1	0,0						
Sulfamethoxazole	1901	520	27,4											5,5	6,5	16,0	37,5	6,7	0,6	0,1	0,1	27,2
Trimethoprim	1901	143	7,5							90,8	1,6	0,1	0,1	0,0	0,0	0,0	7,5					
Tetracycline	1901	484	25,5								18,0	51,6	4,8	0,1	0,2	3,6	3,4	18,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.40: *S.* 4,[5],12:i:- from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	212	4	1,9						77,8	17,5	2,8	0,0	0,9	0,0	0,5	0,5	0,0					
Kanamycin	212	9	4,2										94,3	1,4	0,0	0,0	0,0	0,0	4,2			
Streptomycin	212	200	94,3									0,0	0,9	2,4	2,4	0,0	1,9	24,1	68,4			
Chloramphenicol	212	7	3,3									0,9	23,6	71,2	0,9	0,0	0,0	3,3				
Florfenicol	212	4	1,9									1,4	59,4	35,4	1,9	0,0	0,5	1,4				
Cefotaxime	212	4	1,9				50,0	39,2	8,5	0,5	0,0	0,0	0,0	1,9								
Ceftazidime	212	4	1,9						67,9	27,4	2,8	0,0	1,4	0,5	0,0	0,0						
Nalidixic acid	212	5	2,4										90,1	7,1	0,5	0,0	0,0	2,4				
Ciprofloxacin	212	6	2,8	0,0	4,7	76,4	16,0	0,5	0,0	2,4	0,0	0,0	0,0	0,0	0,0							
Ampicillin	212	199	93,9							0,5	2,8	2,4	0,5	0,0	0,0	0,0	93,9					
Colistin (1)	212													100,0	0,0	0,0						
Sulfamethoxazole	212	199	93,9											0,9	0,0	0,9	4,2	0,0	0,0	0,0	0,5	93,4
Trimethoprim	212	14	6,6							92,9	0,5	0,0	0,0	0,0	0,0	0,0	6,6					
Tetracycline	212	183	86,3								1,4	9,9	2,4	0,0	0,0	0,0	0,0	86,3				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.41: *S.* Subspec. IIIa from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	49	0	0,0						79,6	20,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	49	0	0,0										98,0	2,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	49	0	0,0									40,8	59,2	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	49	0	0,0									6,1	65,3	28,6	0,0	0,0	0,0	0,0				
Florfenicol	49	0	0,0									36,7	63,3	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	49	0	0,0				65,3	26,5	8,2	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	49	0	0,0						89,8	10,2	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	49	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	49	0	0,0	0,0	38,8	61,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	49	0	0,0							16,3	59,2	22,4	2,0	0,0	0,0	0,0	0,0					
Colistin (1)	49													100,0	0,0	0,0						
Sulfamethoxazole	49	0	0,0											2,0	18,4	46,9	32,7	0,0	0,0	0,0	0,0	0,0
Trimethoprim	49	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	49	0	0,0								34,7	65,3	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.42: *S.* Subspec. IIIb from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	175	0	0,0						85,1	13,7	1,1	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	175	1	0,6										98,9	0,6	0,0	0,0	0,0	0,0	0,6			
Streptomycin	175	21	12,0									0,0	1,1	5,7	51,4	29,7	7,4	4,6	0,0			
Chloramphenicol	175	0	0,0									14,9	70,9	13,1	1,1	0,0	0,0	0,0				
Florfenicol	175	0	0,0									37,1	60,6	1,1	1,1	0,0	0,0	0,0				
Cefotaxime	175	0	0,0				86,9	12,6	0,6	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	175	0	0,0						96,0	4,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	175	4	2,3										96,0	1,7	0,0	0,0	1,1	1,1				
Ciprofloxacin	175	3	1,7	14,9	48,6	30,3	4,6	1,1	0,6	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	175	1	0,6							28,6	62,3	8,0	0,6	0,0	0,0	0,0	0,6					
Colistin (1)	175													100,0	0,0	0,0						
Sulfamethoxazole	175	1	0,6											4,0	4,6	23,4	56,6	10,3	0,6	0,0	0,0	0,6
Trimethoprim	175	0	0,0							98,9	1,1	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	175	9	5,1								55,4	38,3	1,1	0,0	0,6	0,0	2,3	2,3				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.43: *S.* Subspec. IV from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
				Distribution (%) of MICs (µg/ml) (3)																		
Gentamicin	62	0	0,0						80,6	19,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	62	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	62	11	17,7									0,0	1,6	6,5	32,3	41,9	14,5	3,2	0,0			
Chloramphenicol	62	0	0,0									1,6	46,8	51,6	0,0	0,0	0,0	0,0				
Florfenicol	62	0	0,0									9,7	72,6	17,7	0,0	0,0	0,0	0,0				
Cefotaxime	62	0	0,0				48,4	40,3	11,3	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	62	0	0,0						67,7	27,4	4,8	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	62	1	1,6										98,4	0,0	0,0	0,0	0,0	1,6				
Ciprofloxacin	62	2	3,2	0,0	22,6	66,1	8,1	1,6	1,6	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	62	0	0,0							6,5	62,9	25,8	4,8	0,0	0,0	0,0	0,0					
Colistin (1)	62													100,0	0,0	0,0						
Sulfamethoxazole	62	1	1,6											1,6	9,7	29,0	43,5	11,3	3,2	0,0	0,0	1,6
Trimethoprim	62	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	62	0	0,0								61,3	37,1	1,6	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.44: *S.* Derby from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
				Distribution (%) of MICs (µg/ml) (3)																		
Gentamicin	25	1	4,0						60,0	32,0	4,0	0,0	0,0	0,0	4,0	0,0	0,0					
Kanamycin	25	0	0,0										96,0	4,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	25	8	32,0									0,0	4,0	36,0	24,0	4,0	0,0	24,0	8,0			
Chloramphenicol	25	0	0,0									0,0	24,0	72,0	4,0	0,0	0,0	0,0				
Florfenicol	25	0	0,0									0,0	56,0	40,0	4,0	0,0	0,0	0,0				
Cefotaxime	25	0	0,0				4,0	64,0	28,0	4,0	0,0	0,0	0,0	0,0								
Ceftazidime	25	0	0,0						8,0	68,0	24,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	25	0	0,0										96,0	4,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	25	0	0,0	0,0	24,0	56,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	25	6	24,0							4,0	44,0	28,0	0,0	0,0	0,0	0,0	24,0					
Colistin (1)	25													100,0	0,0	0,0						
Sulfamethoxazole	25	9	36,0											0,0	4,0	20,0	40,0	0,0	0,0	0,0	0,0	36,0
Trimethoprim	25	6	24,0							76,0	0,0	0,0	0,0	0,0	0,0	0,0	24,0					
Tetracycline	25	8	32,0								8,0	48,0	12,0	0,0	0,0	0,0	0,0	32,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.45: *S.* Dublin from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	41	0	0,0						90,2	9,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	41	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	41	0	0,0									0,0	2,4	56,1	29,3	12,2	0,0	0,0	0,0			
Chloramphenicol	41	1	2,4									0,0	87,8	9,8	0,0	0,0	0,0	2,4				
Florfenicol	41	0	0,0									7,3	85,4	7,3	0,0	0,0	0,0	0,0				
Cefotaxime	41	0	0,0				85,4	9,8	2,4	2,4	0,0	0,0	0,0	0,0								
Ceftazidime	41	0	0,0						87,8	9,8	2,4	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	41	0	0,0										97,6	2,4	0,0	0,0	0,0	0,0				
Ciprofloxacin	41	1	2,4	0,0	39,0	51,2	7,3	2,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	41	1	2,4							48,8	39,0	7,3	2,4	0,0	0,0	0,0	2,4					
Colistin (1)	41													100,0	0,0	0,0						
Sulfamethoxazole	41	1	2,4											4,9	24,4	34,1	34,1	0,0	0,0	0,0	0,0	2,4
Trimethoprim	41	0	0,0							97,6	2,4	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	41	1	2,4								34,1	58,5	4,9	0,0	0,0	0,0	0,0	2,4				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.46: *S.* Enteritidis from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	212	0	0,0						84,0	15,6	0,5	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	212	0	0,0										99,5	0,5	0,0	0,0	0,0	0,0	0,0			
Streptomycin	212	2	0,9									54,7	32,1	8,5	3,3	0,5	0,5	0,0	0,5			
Chloramphenicol	212	0	0,0									0,9	56,6	42,5	0,0	0,0	0,0	0,0				
Florfenicol	212	0	0,0									3,3	89,2	7,5	0,0	0,0	0,0	0,0				
Cefotaxime	212	0	0,0				41,5	54,7	3,8	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	212	0	0,0						77,8	22,2	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	212	6	2,8										96,2	0,9	0,0	0,0	0,9	1,9				
Ciprofloxacin	212	6	2,8	0,0	9,4	78,3	9,4	0,9	1,4	0,0	0,5	0,0	0,0	0,0	0,0							
Ampicillin	212	4	1,9							2,8	65,6	29,2	0,5	0,0	0,0	0,0	1,9					
Colistin (1)	212													100,0	0,0	0,0						
Sulfamethoxazole	212	1	0,5											0,0	3,3	17,9	73,6	4,7	0,0	0,0	0,0	0,5
Trimethoprim	212	0	0,0							98,1	1,9	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	212	1	0,5								13,2	83,0	3,3	0,0	0,0	0,0	0,0	0,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.47: *S.* Saintpaul from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	39	24	61,5						30,8	7,7	0,0	0,0	0,0	43,6	17,9	0,0	0,0					
Kanamycin	39	24	61,5										38,5	0,0	2,6	38,5	5,1	0,0	15,4			
Streptomycin	39	25	64,1									0,0	0,0	2,6	5,1	28,2	38,5	10,3	15,4			
Chloramphenicol	39	0	0,0									5,1	2,6	64,1	28,2	0,0	0,0	0,0				
Florfenicol	39	0	0,0									5,1	28,2	41,0	25,6	0,0	0,0	0,0				
Cefotaxime	39	1	2,6				30,8	15,4	35,9	15,4	2,6	0,0	0,0	0,0								
Ceftazidime	39	0	0,0						35,9	25,6	33,3	5,1	0,0	0,0	0,0	0,0						
Nalidixic acid	39	27	69,2										30,8	0,0	0,0	0,0	2,6	66,7				
Ciprofloxacin	39	27	69,2	0,0	0,0	30,8	0,0	0,0	17,9	0,0	35,9	15,4	0,0	0,0	0,0							
Ampicillin	39	31	79,5							0,0	15,4	0,0	5,1	0,0	0,0	0,0	79,5					
Colistin (1)	39													100,0	0,0	0,0						
Sulfamethoxazole	39	36	92,3											0,0	0,0	0,0	5,1	2,6	0,0	0,0	0,0	92,3
Trimethoprim	39	13	33,3							46,2	17,9	2,6	0,0	0,0	0,0	0,0	33,3					
Tetracycline	39	20	51,3								0,0	2,6	43,6	2,6	0,0	2,6	10,3	38,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.48: *S.* Subspec. I rough from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	42	4	9,5						81,0	9,5	0,0	0,0	0,0	4,8	4,8	0,0	0,0					
Kanamycin	42	3	7,1										92,9	0,0	0,0	2,4	0,0	0,0	4,8			
Streptomycin	42	6	14,3									21,4	16,7	16,7	11,9	19,0	4,8	4,8	4,8			
Chloramphenicol	42	3	7,1									7,1	47,6	35,7	2,4	0,0	0,0	7,1				
Florfenicol	42	1	2,4									14,3	57,1	26,2	0,0	0,0	2,4	0,0				
Cefotaxime	42	0	0,0				16,7	66,7	11,9	4,8	0,0	0,0	0,0	0,0								
Ceftazidime	42	0	0,0						33,3	52,4	9,5	4,8	0,0	0,0	0,0	0,0						
Nalidixic acid	42	10	23,8										73,8	0,0	2,4	0,0	0,0	23,8				
Ciprofloxacin	42	10	23,8	0,0	2,4	57,1	16,7	0,0	7,1	14,3	2,4	0,0	0,0	0,0	0,0							
Ampicillin	42	7	16,7							9,5	38,1	33,3	2,4	0,0	0,0	0,0	16,7					
Colistin (1)	42													100,0	0,0	0,0						
Sulfamethoxazole	42	15	35,7											2,4	7,1	26,2	26,2	0,0	2,4	0,0	0,0	35,7
Trimethoprim	42	2	4,8							92,9	2,4	0,0	0,0	0,0	0,0	0,0	4,8					
Tetracycline	42	15	35,7								19,0	40,5	4,8	0,0	0,0	4,8	4,8	26,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.49: *S.* Typhimurium from animals (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	506	5	1,0						73,5	24,3	1,0	0,2	0,0	0,2	0,6	0,0	0,2					
Kanamycin	506	34	6,7										92,7	0,6	0,0	0,0	0,0	0,0	6,7			
Streptomycin	506	217	42,9									0,0	3,4	25,9	13,0	14,8	20,8	9,7	12,5			
Chloramphenicol	506	124	24,5									2,8	32,6	39,1	1,0	0,0	0,2	24,3				
Florfenicol	506	107	21,1									13,8	49,6	13,4	2,0	7,9	8,1	5,1				
Cefotaxime	506	2	0,4				44,9	45,8	8,3	0,6	0,0	0,0	0,0	0,4								
Ceftazidime	506	2	0,4						70,0	26,5	3,2	0,0	0,2	0,2	0,0	0,0						
Nalidixic acid	506	23	4,5										91,5	3,8	0,2	0,0	0,4	4,2				
Ciprofloxacin	506	26	5,1	0,0	14,0	70,6	10,3	0,6	2,2	2,4	0,0	0,0	0,0	0,0	0,0							
Ampicillin	506	208	41,1							2,2	43,9	12,5	0,4	0,2	0,0	0,0	40,9					
Colistin (1)	506													99,8	0,2	0,0						
Sulfamethoxazole	506	216	42,7											14,4	8,9	4,3	24,1	4,9	0,6	0,0	0,0	42,7
Trimethoprim	506	68	13,4							85,4	1,2	0,0	0,2	0,0	0,0	0,0	13,2					
Tetracycline	506	199	39,3								5,7	48,2	6,7	0,0	0,6	13,0	7,1	18,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.1.3.5 Isolates from food

Tab. 20.50: *Salmonella* spp. from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	883	16	1,8						75,7	21,0	1,4	0,2	0,0	0,5	1,1	0,2	0,0					
Kanamycin	883	40	4,5										95,0	0,5	0,2	0,6	0,3	0,2	3,2			
Streptomycin	883	325	36,8									6,3	9,2	26,0	13,5	8,2	7,6	9,1	20,2			
Chloramphenicol	883	89	10,1									1,7	33,3	52,7	2,3	0,0	0,7	9,4				
Florfenicol	883	63	7,1									4,4	62,3	23,4	2,7	3,9	2,9	0,3				
Cefotaxime	883	11	1,2				33,4	47,9	15,9	1,6	0,0	0,0	0,0	1,2								
Ceftazidime	883	11	1,2						51,2	39,5	7,7	0,3	0,2	0,5	0,0	0,6						
Nalidixic acid	883	99	11,2										84,9	2,9	0,9	0,2	1,0	10,0				
Ciprofloxacin	883	111	12,6	0,3	9,9	67,6	9,6	0,5	5,0	4,6	1,8	0,7	0,0	0,0	0,0							
Ampicillin	883	390	44,2							3,1	35,6	15,9	1,4	0,0	0,0	0,0	44,2					
Colistin (1)	883													100,0	0,0	0,0						
Sulfamethoxazole	883	385	43,6											0,3	2,0	14,9	33,4	5,5	0,1	0,0	0,1	43,5
Trimethoprim	883	136	15,4							82,6	1,9	0,1	0,0	0,0	0,0	0,0	15,4					
Tetracycline	883	381	43,1								9,4	41,7	5,7	0,1	0,1	5,4	4,0	33,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.51: *S.* 4,[5],12:i:- from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	158	0	0,0						77,8	20,3	1,9	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	158	7	4,4										95,6	0,0	0,0	0,0	0,0	0,0	4,4			
Streptomycin	158	141	89,2									0,0	0,6	8,9	0,6	0,6	0,0	23,4	65,8			
Chloramphenicol	158	1	0,6									0,6	32,3	66,5	0,0	0,0	0,6	0,0				
Florfenicol	158	0	0,0									1,3	67,7	30,4	0,6	0,0	0,0	0,0				
Cefotaxime	158	0	0,0				44,3	43,0	12,0	0,6	0,0	0,0	0,0	0,0								
Ceftazidime	158	0	0,0						68,4	27,8	3,2	0,6	0,0	0,0	0,0	0,0						
Nalidixic acid	158	0	0,0										94,9	5,1	0,0	0,0	0,0	0,0				
Ciprofloxacin	158	0	0,0	0,0	2,5	81,6	15,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	158	141	89,2							0,0	7,6	3,2	0,0	0,0	0,0	0,0	89,2					
Colistin (1)	158													100,0	0,0	0,0						
Sulfamethoxazole	158	142	89,9											0,0	1,3	0,0	8,9	0,0	0,0	0,0	0,0	89,9
Trimethoprim	158	6	3,8							96,2	0,0	0,0	0,0	0,0	0,0	0,0	3,8					
Tetracycline	158	134	84,8								0,6	12,7	1,9	0,0	0,0	0,0	0,6	84,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.52: *S.* Derby from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	52	0	0,0						78,8	21,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	52	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	52	4	7,7									0,0	0,0	59,6	26,9	5,8	1,9	3,8	1,9			
Chloramphenicol	52	1	1,9									0,0	13,5	82,7	1,9	0,0	1,9	0,0				
Florfenicol	52	0	0,0									1,9	46,2	50,0	1,9	0,0	0,0	0,0				
Cefotaxime	52	0	0,0				3,8	82,7	13,5	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	52	0	0,0						11,5	76,9	11,5	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	52	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	52	0	0,0	0,0	13,5	69,2	17,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	52	4	7,7							1,9	67,3	21,2	1,9	0,0	0,0	0,0	7,7					
Colistin (1)	52													100,0	0,0	0,0						
Sulfamethoxazole	52	9	17,3											0,0	3,8	30,8	48,1	0,0	0,0	0,0	0,0	17,3
Trimethoprim	52	9	17,3							78,8	3,8	0,0	0,0	0,0	0,0	0,0	17,3					
Tetracycline	52	8	15,4								5,8	69,2	9,6	0,0	0,0	0,0	0,0	15,4				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.53: *S.* Enteritidis from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	105	0	0,0						86,7	13,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	105	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	105	0	0,0									51,4	43,8	4,8	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	105	0	0,0									1,9	46,7	51,4	0,0	0,0	0,0	0,0				
Florfenicol	105	0	0,0									4,8	88,6	6,7	0,0	0,0	0,0	0,0				
Cefotaxime	105	0	0,0				49,5	40,0	10,5	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	105	0	0,0						78,1	21,0	1,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	105	9	8,6										86,7	3,8	1,0	0,0	1,9	6,7				
Ciprofloxacin	105	10	9,5	1,0	13,3	74,3	1,9	0,0	7,6	1,0	1,0	0,0	0,0	0,0	0,0							
Ampicillin	105	9	8,6							1,0	61,9	25,7	2,9	0,0	0,0	0,0	8,6					
Colistin (1)	105													100,0	0,0	0,0						
Sulfamethoxazole	105	0	0,0											0,0	1,0	18,1	76,2	4,8	0,0	0,0	0,0	0,0
Trimethoprim	105	0	0,0							99,0	1,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	105	0	0,0								26,7	71,4	1,9	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.54: *S.* Infantis from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	40	0	0,0						77,5	22,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	40	0	0,0										97,5	2,5	0,0	0,0	0,0	0,0	0,0			
Streptomycin	40	8	20,0									0,0	0,0	45,0	15,0	20,0	15,0	2,5	2,5			
Chloramphenicol	40	1	2,5									0,0	30,0	65,0	2,5	0,0	2,5	0,0				
Florfenicol	40	0	0,0									2,5	50,0	42,5	5,0	0,0	0,0	0,0				
Cefotaxime	40	2	5,0				7,5	57,5	27,5	2,5	0,0	0,0	0,0	5,0								
Ceftazidime	40	2	5,0						12,5	67,5	15,0	0,0	0,0	0,0	0,0	5,0						
Nalidixic acid	40	13	32,5										67,5	0,0	0,0	0,0	2,5	30,0				
Ciprofloxacin	40	13	32,5	0,0	2,5	57,5	7,5	0,0	10,0	15,0	7,5	0,0	0,0	0,0	0,0							
Ampicillin	40	4	10,0							5,0	55,0	27,5	2,5	0,0	0,0	0,0	10,0					
Colistin (1)	40													100,0	0,0	0,0						
Sulfamethoxazole	40	17	42,5											0,0	0,0	17,5	32,5	7,5	0,0	0,0	0,0	42,5
Trimethoprim	40	2	5,0							95,0	0,0	0,0	0,0	0,0	0,0	0,0	5,0					
Tetracycline	40	14	35,0								10,0	47,5	7,5	0,0	0,0	0,0	12,5	22,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.55: *S.* Newport from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	25	0	0,0						72,0	28,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	25	2	8,0										92,0	0,0	0,0	0,0	0,0	0,0	8,0			
Streptomycin	25	0	0,0									0,0	8,0	60,0	24,0	8,0	0,0	0,0	0,0			
Chloramphenicol	25	0	0,0									4,0	52,0	40,0	4,0	0,0	0,0	0,0				
Florfenicol	25	0	0,0									16,0	80,0	4,0	0,0	0,0	0,0	0,0				
Cefotaxime	25	0	0,0				48,0	40,0	12,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	25	0	0,0						80,0	16,0	4,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	25	4	16,0										80,0	4,0	0,0	0,0	0,0	16,0				
Ciprofloxacin	25	5	20,0	4,0	12,0	52,0	12,0	0,0	0,0	16,0	0,0	4,0	0,0	0,0	0,0							
Ampicillin	25	16	64,0							4,0	20,0	12,0	0,0	0,0	0,0	0,0	64,0					
Colistin (1)	25													100,0	0,0	0,0						
Sulfamethoxazole	25	3	12,0											0,0	0,0	56,0	24,0	8,0	0,0	0,0	0,0	12,0
Trimethoprim	25	1	4,0							88,0	8,0	0,0	0,0	0,0	0,0	0,0	4,0					
Tetracycline	25	17	68,0								24,0	8,0	0,0	0,0	0,0	0,0	4,0	64,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.56: *S.* Paratyphi B dT+ from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	38	3	7,9						84,2	7,9	0,0	0,0	0,0	0,0	5,3	2,6	0,0					
Kanamycin	38	4	10,5										89,5	0,0	0,0	0,0	0,0	2,6	7,9			
Streptomycin	38	9	23,7									0,0	0,0	2,6	18,4	55,3	5,3	10,5	7,9			
Chloramphenicol	38	6	15,8									5,3	34,2	42,1	2,6	0,0	5,3	10,5				
Florfenicol	38	0	0,0									18,4	55,3	23,7	2,6	0,0	0,0	0,0				
Cefotaxime	38	7	18,4				7,9	42,1	31,6	0,0	0,0	0,0	0,0	18,4								
Ceftazidime	38	7	18,4						10,5	63,2	7,9	0,0	5,3	5,3	0,0	7,9						
Nalidixic acid	38	30	78,9										15,8	2,6	2,6	0,0	0,0	78,9				
Ciprofloxacin	38	31	81,6	0,0	0,0	13,2	5,3	5,3	42,1	28,9	2,6	2,6	0,0	0,0	0,0							
Ampicillin	38	15	39,5							2,6	23,7	28,9	5,3	0,0	0,0	0,0	39,5					
Colistin (1)	38													100,0	0,0	0,0						
Sulfamethoxazole	38	17	44,7											2,6	7,9	34,2	7,9	2,6	0,0	0,0	2,6	42,1
Trimethoprim	38	37	97,4							2,6	0,0	0,0	0,0	0,0	0,0	0,0	97,4					
Tetracycline	38	9	23,7								21,1	50,0	5,3	0,0	0,0	0,0	0,0	23,7				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.57: *S.* Saintpaul from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	26	10	38,5						34,6	26,9	0,0	0,0	0,0	15,4	23,1	0,0	0,0					
Kanamycin	26	10	38,5										61,5	0,0	7,7	19,2	11,5	0,0	0,0			
Streptomycin	26	15	57,7									0,0	0,0	15,4	3,8	23,1	30,8	11,5	15,4			
Chloramphenicol	26	0	0,0									0,0	15,4	57,7	26,9	0,0	0,0	0,0				
Florfenicol	26	0	0,0									0,0	46,2	26,9	26,9	0,0	0,0	0,0				
Cefotaxime	26	0	0,0				11,5	26,9	42,3	19,2	0,0	0,0	0,0	0,0								
Ceftazidime	26	0	0,0						19,2	34,6	38,5	7,7	0,0	0,0	0,0	0,0						
Nalidixic acid	26	12	46,2										34,6	7,7	11,5	0,0	7,7	38,5				
Ciprofloxacin	26	18	69,2	0,0	3,8	23,1	3,8	0,0	7,7	11,5	34,6	15,4	0,0	0,0	0,0							
Ampicillin	26	20	76,9							0,0	7,7	15,4	0,0	0,0	0,0	0,0	76,9					
Colistin (1)	26													100,0	0,0	0,0						
Sulfamethoxazole	26	15	57,7											0,0	0,0	0,0	23,1	19,2	0,0	0,0	0,0	57,7
Trimethoprim	26	5	19,2							61,5	19,2	0,0	0,0	0,0	0,0	0,0	19,2					
Tetracycline	26	12	46,2								0,0	23,1	30,8	0,0	0,0	0,0	0,0	46,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.58: *S.* Senftenberg from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	37	0	0,0						81,1	18,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	37	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	37	0	0,0									0,0	2,7	70,3	24,3	2,7	0,0	0,0	0,0			
Chloramphenicol	37	0	0,0									0,0	32,4	67,6	0,0	0,0	0,0	0,0				
Florfenicol	37	0	0,0									0,0	78,4	21,6	0,0	0,0	0,0	0,0				
Cefotaxime	37	0	0,0				5,4	48,6	40,5	5,4	0,0	0,0	0,0	0,0								
Ceftazidime	37	0	0,0						24,3	54,1	21,6	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	37	2	5,4										94,6	0,0	0,0	0,0	2,7	2,7				
Ciprofloxacin	37	2	5,4	0,0	29,7	62,2	2,7	2,7	2,7	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	37	0	0,0							2,7	54,1	37,8	5,4	0,0	0,0	0,0	0,0					
Colistin (1)	37													100,0	0,0	0,0						
Sulfamethoxazole	37	0	0,0											0,0	2,7	37,8	48,6	10,8	0,0	0,0	0,0	0,0
Trimethoprim	37	0	0,0							97,3	2,7	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	37	0	0,0								10,8	78,4	10,8	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.59: *S.* Subspec. I rough from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	33	1	3,0						66,7	27,3	3,0	0,0	0,0	0,0	3,0	0,0	0,0					
Kanamycin	33	1	3,0										97,0	0,0	0,0	0,0	0,0	0,0	3,0			
Streptomycin	33	19	57,6									0,0	9,1	21,2	6,1	6,1	0,0	12,1	45,5			
Chloramphenicol	33	7	21,2									9,1	18,2	48,5	3,0	0,0	0,0	21,2				
Florfenicol	33	2	6,1									12,1	30,3	36,4	15,2	3,0	3,0	0,0				
Cefotaxime	33	0	0,0				9,1	66,7	24,2	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	33	0	0,0						21,2	66,7	12,1	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	33	0	0,0										97,0	3,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	33	0	0,0	0,0	9,1	72,7	18,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	33	24	72,7							0,0	21,2	6,1	0,0	0,0	0,0	0,0	72,7					
Colistin (1)	33													100,0	0,0	0,0						
Sulfamethoxazole	33	23	69,7											0,0	0,0	12,1	18,2	0,0	0,0	0,0	0,0	69,7
Trimethoprim	33	11	33,3							63,6	3,0	0,0	0,0	0,0	0,0	0,0	33,3					
Tetracycline	33	23	69,7								6,1	18,2	6,1	0,0	3,0	9,1	3,0	54,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.60: *S.* Typhimurium from food (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	185	1	0,5						70,3	26,5	2,2	0,5	0,0	0,0	0,5	0,0	0,0					
Kanamycin	185	10	5,4										93,5	1,1	0,0	0,0	0,0	0,0	5,4			
Streptomycin	185	112	60,5									0,0	2,2	14,1	16,8	6,5	21,6	13,5	25,4			
Chloramphenicol	185	67	36,2									1,6	19,5	40,5	2,2	0,0	0,0	36,2				
Florfenicol	185	59	31,9									2,2	43,2	21,1	1,6	17,8	13,5	0,5				
Cefotaxime	185	0	0,0				40,5	42,2	14,6	2,7	0,0	0,0	0,0	0,0								
Ceftazidime	185	0	0,0						63,8	31,4	4,9	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	185	12	6,5										90,3	3,2	0,0	0,5	0,0	5,9				
Ciprofloxacin	185	12	6,5	0,0	7,6	74,1	11,9	0,0	3,8	2,2	0,5	0,0	0,0	0,0	0,0							
Ampicillin	185	136	73,5							0,0	14,1	11,9	0,5	0,0	0,0	0,0	73,5					
Colistin (1)	185													100,0	0,0	0,0						
Sulfamethoxazole	185	134	72,4											0,0	1,6	5,4	16,2	3,8	0,5	0,0	0,0	72,4
Trimethoprim	185	42	22,7							75,7	1,6	0,0	0,0	0,0	0,0	0,0	22,7					
Tetracycline	185	130	70,3								1,1	22,2	6,5	0,0	0,0	24,3	9,2	36,8				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.2 *Salmonella* isolates from animals

20.2.1 Distribution of the serovars in animals

Tab. 20.61: The ten most frequent serovars in animals, livestock and the four main livestock species (2009)

Serovar	Animal total		Chicken		Turkey		Cattle		Pig		Livestock		Other animals	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Number of isolates	1.901	59.4	315	0	87	0	221	0	343	0	966	0	935	0
S. Typhimurium	506	26,6	25	7,9	19	21,8	69	31,2	155	45,2	268	27,7	238	25,5
S. 4,[5],12:i:-	212	11,2	12	3,8	4	4,6	67	30,3	110	32,1	193	20,0	19	2,0
S. Enteritidis	212	11,2	136	43,2	1	1,1	11	5,0	8	2,3	156	16,1	56	6,0
S. Subspec. IIIb	175	9,2	1	0,3	0	0,0	2	0,9	0	0,0	3	0,3	172	18,4
S. Subspec. IV	62	3,3	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	62	6,6
S. Subspec. IIIa	49	2,6	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	49	5,2
S. Subspec. I rough	42	2,2	25	7,9	3	3,4	2	0,9	6	1,7	36	3,7	6	0,6
S. Dublin	41	2,2	0	0,0	0	0,0	39	17,6	1	0,3	40	4,1	1	0,1
S. Saintpaul	39	2,1	4	1,3	31	35,6	0	0,0	0	0,0	35	3,6	4	0,4
S. Derby	25	1,3	1	0,3	0	0,0	3	1,4	20	5,8	24	2,5	1	0,1
S. Infantis	24	1,3	10	3,2	2	2,3	2	0,9	7	2,0	21	2,2	3	0,3
S. Mbandaka	20	1,1	7	2,2	0	0,0	0	0,0	1	0,3	8	0,8	12	1,3
S. Livingstone	18	0,9	9	2,9	0	0,0	0	0,0	5	1,5	14	1,4	4	0,4
S. Senftenberg	18	0,9	8	2,5	1	1,1	2	0,9	0	0,0	11	1,1	7	0,7
S. Tennessee	17	0,9	7	2,2	0	0,0	0	0,0	0	0,0	7	0,7	10	1,1
S. Paratyphi B dT+	16	0,8	6	1,9	0	0,0	0	0,0	0	0,0	6	0,6	10	1,1
S. Anatum	14	0,7	5	1,6	0	0,0	4	1,8	3	0,9	12	1,2	2	0,2
S. Newport	14	0,7	0	0,0	3	3,4	0	0,0	0	0,0	3	0,3	11	1,2
S. London	13	0,7	0	0,0	0	0,0	1	0,5	11	3,2	12	1,2	1	0,1
S. Ohio	13	0,7	6	1,9	0	0,0	0	0,0	5	1,5	11	1,1	2	0,2
S. Montevideo	13	0,7	3	1,0	2	2,3	0	0,0	0	0,0	5	0,5	8	0,9
S. 9,12:-:-	9	0,5	2	0,6	0	0,0	6	2,7	1	0,3	9	0,9	0	0,0
S. 4,12:d:-	8	0,4	6	1,9	1	1,1	0	0,0	1	0,3	8	0,8	0	0,0
S. Heidelberg	5	0,3	0	0,0	5	5,7	0	0,0	0	0,0	5	0,5	0	0,0
S. Minnesota	3	0,2	0	0,0	2	2,3	0	0,0	0	0,0	2	0,2	1	0,1
S. Goldcoast	3	0,2	0	0,0	0	0,0	3	1,4	0	0,0	3	0,3	0	0,0
S. Muenster	3	0,2	0	0,0	0	0,0	2	0,9	0	0,0	2	0,2	1	0,1
S. Give	2	0,1	0	0,0	2	2,3	0	0,0	0	0,0	2	0,2	0	0,0
S. Schwarzengrund	2	0,1	0	0,0	2	2,3	0	0,0	0	0,0	2	0,2	0	0,0
Other serovars	323	17,0	42	13,3	9	10,3	8	3,6	9	2,6	68	7,0	255	27,3

Tab. 20.62: Development of proportions of the ten most frequent serovars from cattle (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	408	330	542	362	315	279	338	304	334	221	3433
S. Typhimurium	70,6	85,8	79,5	57,2	59,7	54,8	48,2	38,2	36,8	31,2	58,9
S. 4,[5],12:i:-	0,0	0,6	0,2	0,0	2,5	1,1	3,8	10,5	13,2	30,3	5,0
S. Dublin	0,0	0,3	2,6	3,6	4,1	5,7	4,7	2,6	9,9	17,6	4,5
S. Enteritidis	2,5	5,2	3,7	12,7	4,1	9,7	8,3	7,9	13,5	5,0	7,0
S. 9,12:-:-	1,2	0,3	5,2	0,8	1,0	2,2	2,7	2,3	1,5	2,7	2,1
S. Anatum	2,0	0,0	1,3	3,3	2,9	1,4	9,2	7,2	4,2	1,8	3,2
S. Goldcoast	0,0	0,0	0,2	0,0	0,3	2,5	0,3	1,0	1,2	1,4	0,6
S. Derby	0,5	0,0	0,0	0,3	0,0	0,7	1,2	0,7	0,6	1,4	0,5
S. Infantis	4,4	0,3	0,6	4,4	5,7	0,7	3,3	6,6	1,5	0,9	2,8
S. Subspec. I rough	2,2	2,4	2,0	4,7	1,3	1,8	1,8	3,3	0,9	0,9	2,2
S. Senftenberg	8,6	0,3	0,2	0,0	0,0	0,0	0,3	0,0	0,3	0,9	1,2
S. Muenster	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,8	0,9	0,2
S. Subspec. IIIb	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,9	0,1
Other serovars	8,1	4,8	4,6	13,0	18,4	19,4	16,3	19,7	14,7	4,1	11,8

Tab. 20.63: Development of proportions of the ten most frequent serovars from pigs (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	548	285	259	425	411	414	462	498	518	343	4163
S. Typhimurium	82,8	81,1	82,2	68,5	72,7	72,5	64,9	56,0	44,0	45,2	62,3
S. 4,[5],12:i:-	0,0	0,4	1,9	5,9	5,1	6,3	10,0	19,3	21,2	32,1	7,9
S. Derby	5,1	7,4	5,0	7,8	9,7	6,8	7,6	8,8	11,0	5,8	7,2
S. London	1,3	1,8	1,2	0,5	0,5	1,2	2,2	2,0	1,7	3,2	1,3
S. Enteritidis	0,7	1,1	0,8	4,0	0,2	1,4	1,5	1,8	2,5	2,3	1,5
S. Infantis	0,5	0,4	1,2	1,2	0,5	1,7	1,7	1,6	3,1	2,0	1,3
S. Subspec. I rough	0,7	1,4	0,4	1,2	0,7	2,9	2,6	2,4	4,6	1,7	1,8
S. Livingstone	0,7	1,1	0,4	0,5	0,0	1,0	1,3	1,4	0,4	1,5	0,7
*S.*Ohio	0,0	0,0	0,4	0,0	0,7	0,0	1,1	0,6	0,2	1,5	0,3
S. Anatum	0,9	0,0	0,4	3,8	0,0	0,2	1,3	0,4	1,4	0,9	0,9
S. Panama	0,0	0,0	0,0	1,9	0,0	0,0	0,6	0,0	0,6	0,6	0,3
S. of group D1	0,0	0,0	0,4	0,5	0,0	0,2	0,0	0,2	0,0	0,6	0,1
Other serovars	7,1	5,6	5,8	4,5	9,7	5,8	5,2	5,4	9,3	2,6	14,3

Tab. 20.64: Development of proportions of the ten most frequent serovars from chicken (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	341	455	300	372	539	199	149	208	364	315	3242
S. Enteritidis	19,6	24,4	37,7	18,0	10,0	20,6	26,8	47,1	38,5	43,2	26,7
S. Typhimurium	9,4	10,3	6,0	4,0	9,1	13,1	10,1	10,6	4,1	7,9	8,1
S. Subspec. I rough	1,8	2,0	4,0	1,3	1,7	3,0	2,7	6,7	4,4	7,9	3,3
S. 4,[5],12:i:-	0,0	0,2	0,7	0,3	1,1	6,0	1,3	1,9	1,4	3,8	1,4
S. Infantis	0,6	2,4	1,7	18,0	16,0	11,1	12,1	0,5	2,7	3,2	7,2
S. Livingstone	14,7	3,7	2,7	8,6	6,7	1,0	1,3	3,4	5,5	2,9	5,6
S. Senftenberg	0,6	2,4	1,7	0,5	0,6	1,5	0,7	0,0	0,5	2,5	1,1
S. Mbandaka	2,1	4,4	2,3	3,5	1,1	2,5	0,0	5,8	2,5	2,2	2,7
S. Tennessee	0,6	0,9	0,7	0,0	0,2	0,5	0,0	0,0	0,0	2,2	0,5
S. 4,12:d:-	22,0	33,8	0,7	8,6	21,3	1,0	4,0	3,8	19,2	1,9	14,5
S. Paratyphi B dT+	4,4	2,6	17,0	9,4	10,6	13,1	8,7	2,9	3,0	1,9	7,2
S. Ohio	0,0	0,0	0,0	0,5	0,0	1,5	0,0	0,5	1,1	1,9	0,5
Other serovars	24,3	12,7	25,0	27,2	21,7	25,1	32,2	16,8	17,0	18,4	21,2

Tab. 20.65: Development of proportions of the ten most frequent serovars from turkeys (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	48	179	318	172	108	117	141	80	72	87	1322
S. Saintpaul	0,0	2,2	36,2	30,8	10,2	24,8	12,8	31,3	41,7	35,6	25,6
S. Typhimurium	2,1	16,8	4,7	9,3	31,5	10,3	9,2	8,8	6,9	21,8	12,3
S. Heidelberg	20,8	24,6	21,7	21,5	6,5	2,6	10,6	1,3	0,0	5,7	15,5
S. 4,[5],12:i:-	0,0	0,0	0,0	0,0	0,0	0,9	0,7	1,3	2,8	4,6	0,7
S. Subspec. I rough	2,1	1,7	2,5	1,2	5,6	6,8	0,7	0,0	4,2	3,4	2,8
S. Newport	4,2	0,6	0,0	0,0	0,0	0,0	0,0	0,0	2,8	3,4	0,6
S. Montevideo	0,0	0,6	0,3	2,3	4,6	11,1	0,7	1,3	0,0	2,3	2,3
S. Infantis	2,1	2,8	0,3	0,0	0,0	0,9	0,0	0,0	1,4	2,3	0,9
S. Minnesota	0,0	0,0	0,3	0,0	0,0	0,0	0,0	0,0	1,4	2,3	0,3
S. Schwarzengrund	0,0	0,0	0,0	0,0	0,0	0,0	1,4	0,0	0,0	2,3	0,3
S. Give	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,3	0,2
S. Enteritidis	29,2	5,0	2,8	1,2	7,4	6,8	2,8	10,0	2,8	1,1	5,3
Other serovars	39,6	45,8	31,1	33,7	34,3	35,9	61,0	46,3	36,1	12,6	40,2

20.2.2 Development of resistance rates in Salmonella isolates from animals

20.2.2.1 Isolates from pigs

Tab. 20.66: Resistance rates in *Salmonella* isolates from pigs (2009)

Year	*Salmonella* spp.	*S.* Typhimurium	*S.* Enteritidis	*S.* 4,[5],12:i:-	*S.* Derby
Tested isolates	343	155	8	110	20
Susceptible	19,2	12,9	87,5	3,6	60,0
Resistant	80,8	87,1	12,5	96,4	40,0
Multiresistant (2)	75,2	81,9	12,5	94,5	35,0
Gentamicin	4,7	2,6	0,0	3,6	5,0
Kanamycin	9,6	13,5	0,0	6,4	0,0
Streptomycin	70,0	72,9	12,5	93,6	30,0
Chloramphenicol	21,3	40,6	0,0	4,5	0,0
Florfenicol	16,9	34,2	0,0	2,7	0,0
Cefotaxime (1)	2,0	1,3	0,0	1,8	0,0
Ceftazidime (1)	1,7	1,3	0,0	1,8	0,0
Nalidixic acid	1,7	0,6	0,0	0,0	0,0
Ciprofloxacin	2,6	1,3	0,0	0,9	0,0
Ampicillin	73,5	82,6	12,5	93,6	25,0
Sulfamethoxazol	74,3	82,6	12,5	93,6	35,0
Trimethoprim (1)	23,0	32,3	0,0	10,9	25,0
Tetracycline	67,9	76,1	12,5	83,6	35,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.67: Resistance rates in *Salmonella* spp. isolates from pigs

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	548	285	259	425	411	414	462	498	518	343
Susceptible	6,9	10,2	17,8	17,2	16,3	17,4	24,2	18,5	22	19,2
Resistant	93,1	89,8	82,2	82,8	83,7	82,6	75,8	81,5	78	80,8
Multiresistant (2)	81,6	74	76,1	74,8	73,2	75,1	70,3	74,9	68,1	75,2
Gentamicin	3,5	2,8	5	3,5	6,8	5,8	4,5	3,2	5,2	4,7
Kanamycin	4,2	6,7	5,8	10,8	11,2	12,8	12,1	10	7,9	9,6
Streptomycin	73,7	68,4	71,4	69,2	67,9	70,5	65,6	66,1	59,1	70,0
Chloramphenicol	47,6	47,7	49,8	34,4	35,8	40,6	30,7	29,1	19,5	21,3
Florfenicol	39,8	44,6	45,6	31,1	33,1	35,3	27,3	24,7	17,2	16,9
Cefotaxime (1)	-	-	-	-	-	-	-	0	0,8	2,0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0,4	1,7
Nalidixic acid	3,1	2,5	3,9	1,6	1,2	2,7	4,3	2,2	5	1,7
Ciprofloxacin	4,9	3,2	3,5	1,9	1,7	3,9	5,4	4,8	5	2,6
Ampicillin	72,1	57,9	67,2	69,4	63,5	67,9	66,5	70,1	61,8	73,5
Sulfamethoxazol	90,5	83,5	75,3	76,9	79,8	74,6	69,3	74,3	66,6	74,3
Trimethoprim (1)	-	-	-	-	-	-	-	42,9	24,9	23,0
Tetracycline	78,8	71,2	74,9	72,2	66,4	74,9	66,9	72,7	69,5	67,9

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.68: Resistance rates in *S.* Typhimurium from pigs

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	454	231	213	291	299	300	300	279	228	155
Susceptible	3,3	5,6	12,2	5,5	7,4	7,3	12,7	7,2	11,8	12,9
Resistant	96,7	94,4	87,8	94,5	92,6	92,7	87,3	92,8	88,2	87,1
Multiresistant (2)	89,9	82,7	84	91,4	85,6	86,3	84	87,5	83,8	81,9
Gentamicin	3,5	3	6,1	4,1	8,4	6,3	6	3,6	9,2	2,6
Kanamycin	3,7	4,8	6,6	10	14,4	14,3	14,7	11,1	12,7	13,5
Streptomycin	83,3	78,4	79,3	85,9	81,6	81,3	79	78,9	71,5	72,9
Chloramphenicol	55,7	57,6	58,7	47,8	46,2	51,7	42,3	42,7	37,3	40,6
Florfenicol	47,4	54,1	54	44	44,1	48,3	38,3	40,1	33,8	34,2
Cefotaxime (1)	-	-	-	-	-	-	-	0	0,4	1,3
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	1,3
Nalidixic acid	3,5	2,6	3,8	1,4	1,7	3,7	4	3,2	7	0,6
Ciprofloxacin	5,1	3,5	3,3	1,7	2	4,7	5	5,7	7	1,3
Ampicillin	83,9	70,1	77,9	85,9	78,6	78,3	80,7	84,6	78,5	82,6
Sulfamethoxazol	95,2	91,8	84	92,4	90	86,3	83,3	87,5	82	82,6
Trimethoprim (1)	-	-	-	-	-	-	-	0	33,3	32,3
Tetracycline	86,8	77,5	82,2	89	77,9	85	77,7	84,2	81,6	76,1

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.69: Resistance rates in *S.* Enteritidis from pigs

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	4	3	2	17	1	6	7	9	13	8
Susceptible	75	100	50	94,1	100	83,3	100	88,9	100	87,5
Resistant	25	0	50	5,9	0	16,7	0	11,1	0	12,5
Multiresistant (2)	0	0	50	0	0	16,7	0	11,1	0	12,5
Gentamicin	0	0	0	0	0	0	0	0	0	0,0
Kanamycin	0	0	0	0	0	0	0	0	0	0,0
Streptomycin	0	0	0	0	0	0	0	0	0	12,5
Chloramphenicol	0	0	0	0	0	0	0	11,1	0	0,0
Florfenicol	0	0	0	0	0	0	0	11,1	0	0,0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0,0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0,0
Nalidixic acid	0	0	0	0	0	0	0	0	0	0,0
Ciprofloxacin	0	0	0	0	0	0	0	0	0	0,0
Ampicillin	0	0	0	0	0	0	0	11,1	0	12,5
Sulfamethoxazol	25	0	0	0	0	16,7	0	11,1	0	12,5
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	0,0
Tetracycline	0	0	0	0	0	16,7	0	11,1	0	12,5

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.70: Resistance rates in *S.* 4,[5],12:i:- from pigs

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	0	1	5	25	21	26	46	96	110	110
Susceptible	-	0	0	0	4,8	3,8	2,2	2,1	4,5	3,6
Resistant		100	100	100	95,2	96,2	97,8	97,9	95,5	96,4
Multiresistant (2)	-	100	100	96	81	80,8	80,4	86,5	88,2	94,5
Gentamicin	-	0	0	0	0	0	0	3,1	3,6	3,6
Kanamycin	-	0	20	8	0	3,8	2,2	9,4	6,4	6,4
Streptomycin	-	100	80	84	71,4	76,9	80,4	83,3	85,5	93,6
Chloramphenicol	-	100	0	12	9,5	7,7	10,9	11,5	1,8	4,5
Florfenicol	-	100	0	4	4,8	0	10,9	5,2	0,9	2,7
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	1,8
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	1,8
Nalidixic acid	-	0	0	0	0	0	8,7	1	1,8	0,0
Ciprofloxacin	-	0	0	0	4,8	0	10,9	7,3	1,8	0,9
Ampicillin	-	100	80	84	66,7	76,9	78,3	84,4	88,2	93,6
Sulfamethoxazol	-	100	80	84	90,5	80,8	80,4	85,4	86,4	93,6
Trimethoprim (1)	-	-	-	-	-	-	-	75	10	10,9
Tetracycline	-	100	100	96	76,2	92,3	95,7	90,6	91,8	83,6

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.71: Resistance rates in *S.* Derby from pigs

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	28	21	13	33	40	28	35	44	57	20,0
Susceptible	21,4	33,3	46,2	42,4	60	71,4	74,3	52,3	26,3	60,0
Resistant	78,6	66,7	53,8	57,6	40	28,6	25,7	47,7	73,7	40,0
Multiresistant (2)	35,7	19	23,1	15,2	32,5	14,3	20	40,9	35,1	35,0
Gentamicin	0	4,8	0	0	0	0	0	2,3	0	5,0
Kanamycin	0	4,8	0	36,4	0	0	2,9	2,3	0	0,0
Streptomycin	28,6	33,3	30,8	6,1	20	10,7	11,4	25	22,8	30,0
Chloramphenicol	0	0	0	0	2,5	3,6	2,9	11,4	3,5	0
Florfenicol	0	0	0	0	0	0	0	6,8	3,5	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	0	4,8	0	0	0	0	8,6	0	0	0
Ciprofloxacin	0	4,8	0	0	0	0	8,6	0	0	0
Ampicillin	0	4,8	0	15,2	5	7,1	14,3	29,5	12,3	25,0
Sulfamethoxazol	71,4	23,8	23,1	21,2	22,5	14,3	14,3	38,6	42,1	35,0
Trimethoprim (1)	-	-	-	-	-	-	-	-	31,6	25,0
Tetracycline	35,7	38,1	38,5	12,1	35	17,9	11,4	31,8	59,6	35,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.2.2.2 Isolates from cattle

Tab. 20.72: Resistance rates in *Salmonella* isolates from cattle

	Salmonella spp.	*S.* Typhimurium	*S.* Enteritidis	*S.* Dublin	*S.* Anatum	*S.* 4,[5],12:i:-
Tested isolates	221	69	11	39	4	67
Susceptible	48,0	42,0	72,7	97,4	75,0	3,0
Resistant	52,0	58,0	27,3	2,6	25,0	97,0
Multiresistant (2)	48,0	52,2	0,0	2,6	0,0	97,0
Gentamicin	0,0	0,0	0,0	0,0	0,0	0,0
Kanamycin	2,7	8,7	0,0	0,0	0,0	0,0
Streptomycin	46,6	50,7	0,0	0,0	25,0	97,0
Chloramphenicol	10,4	30,4	0,0	2,6	0,0	0,0
Florfenicol	10,0	30,4	0,0	0,0	0,0	0,0
Cefotaxime (1)	0,9	0,0	0,0	0,0	0,0	1,5
Ceftazidime (1)	0,9	0,0	0,0	0,0	0,0	1,5
Nalidixic acid	6,8	10,1	27,3	0,0	0,0	7,5
Ciprofloxacin	7,2	10,1	27,3	0,0	0,0	7,5
Ampicillin	44,8	43,5	0,0	2,6	0,0	97,0
Sulfamethoxazol	48,0	53,6	0,0	2,6	0,0	97,0
Trimethoprim (1)	4,5	11,6	0,0	0,0	0,0	1,5
Tetracycline	44,8	47,8	0,0	2,6	0,0	92,5

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.73: Development of resistance rates in *Salmonella* spp. from cattle

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	408	330	542	362	315	279	338	304	334	221
Susceptible	16,9	9,4	39,3	45,6	32,1	48,4	59,2	61,8	58,4	48,0
Resistant	83,1	90,6	60,7	54,4	67,9	51,6	40,8	38,2	41,6	52,0
Multiresistant (2)	54,9	82,7	56,6	51,9	59	47,3	38,5	32,2	38,3	48,0
Gentamicin	1,5	0,6	1,3	0,3	1	1,1	0,3	0,7	0,6	0,0
Kanamycin	6,6	1,8	1,1	1,7	7,9	1,4	2,1	5,3	1,5	2,7
Streptomycin	52,5	75,5	54,8	50,6	57,5	43	36,4	30,9	35	46,6
Chloramphenicol	43,1	70,9	40	31,5	43,8	40,9	21,6	12,5	13,5	10,4
Florfenicol	34,8	65,8	38,9	30,1	43,5	40,1	20,4	11,5	13,2	10,0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0,9
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0,9
Nalidixic acid	1,5	1,2	7,7	3,3	1,9	2,9	0,3	2,6	2,4	6,8
Ciprofloxacin	3,7	1,5	7,7	3,6	2,2	2,9	0,9	4,9	2,7	7,2
Ampicillin	52,2	74,2	55,5	45,3	57,8	46,6	33,1	31,3	37,4	44,8
Sulfamethoxazol	80,9	89,1	57,2	51,4	66	47	39,1	32,6	38	48,0
Trimethoprim (1)	-	-	-	-	-	-	-	11,1	6,9	4,5
Tetracycline	52,2	70,9	53,5	45,9	58,4	45,9	36,7	30,3	38	44,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.74: Development of resistance rates in *S.* Typhimurium from cattle

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	288	283	431	207	188	153	163	116	123	69
Susceptible	10,1	0,7	27,4	19,3	3,7	15	24,5	43,1	28,5	42,0
Resistant	89,9	99,3	72,6	80,7	96,3	85	75,5	56,9	71,5	58,0
Multiresistant (2)	75	94	68,4	79,2	89,9	80,4	71,8	51,7	65,9	52,2
Gentamicin	1,7	0,7	0,9	0	1,6	2	0,6	1,7	0,8	0,0
Kanamycin	9	1,4	0,7	1,4	12,8	2	3,1	8,6	3,3	8,7
Streptomycin	73,3	86,2	67,7	78,3	89,9	74,5	68,1	47,4	60,2	50,7
Chloramphenicol	59,7	82	49,7	52,7	72,9	73,2	42,9	32,8	35	30,4
Florfenicol	49	76	48,3	51,2	72,3	71,9	40,5	30,2	34,1	30,4
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0,0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0,0
Nalidixic acid	1	1,1	8,8	3,9	0,5	3,3	0,6	6	1,6	10,1
Ciprofloxacin	3,5	1,4	8,8	4,3	1,1	3,3	1,8	6,9	1,6	10,1
Ampicillin	72,6	84,8	68,2	71	88,3	80,4	62	49,1	65,9	43,5
Sulfamethoxazol	88,9	98,6	69,4	79,7	96,3	80,4	73	53,4	65,9	53,6
Trimethoprim (1)	-	-	-	-	-	-	-	20	14,6	11,6
Tetracycline	72,6	80,6	66,1	73,4	88,8	79,1	68,7	45,7	67,5	47,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.75: Development of resistance rates in *S.* 4,[5],12:i:- from cattle

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	0	2	1	0	8	3	13	32	44	67
Susceptible	-	0	0	-	0	33,3	23,1	3,1	9,1	3,0
Resistant		100	100		100	66,7	76,9	96,9	90,9	97,0
Multiresistant (2)	-	50	100	-	100	66,7	69,2	93,8	90,9	97,0
Gentamicin	-	0	0	-	0	0	0	0	0	0,0
Kanamycin	-	0	0	-	0	0	15,4	3,1	0	0,0
Streptomycin	-	50	100	-	100	66,7	61,5	90,6	90,9	97,0
Chloramphenicol	-	0	0	-	0	0	0	0	0	0,0
Florfenicol	-	0	0	-	0	0	0	0	0	0,0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	1,5
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	1,5
Nalidixic acid	-	0	0	-	0	0	0	0	0	7,5
Ciprofloxacin	-	0	0	-	0	0	0	0	2,3	7,5
Ampicillin	-	50	100	-	100	66,7	69,2	93,8	88,6	97,0
Sulfamethoxazol	-	100	100	-	100	66,7	61,5	93,8	90,9	97,0
Trimethoprim (1)	-	-	-	-	-	-	-	0	2,3	1,5
Tetracycline	-	50	100	-	100	33,3	76,9	96,9	90,9	92,5

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.76: Development of resistance rates in *S.* Dublin from cattle

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	0	1	14	13	13	16	16	8	33	39
Susceptible	-	100	100	92,3	100	93,8	87,5	75	93,9	97,4
Resistant	-	0	0	7,7	0	6,3	12,5	25	6,1	2,6
Multiresistant (2)	-	0	0	7,7	0	0	12,5	12,5	0	2,6
Gentamicin	-	0	0	0	0	0	0	0	0	0,0
Kanamycin	-	0	0	0	0	0	0	0	0	0,0
Streptomycin	-	0	0	0	0	0	12,5	0	0	0,0
Chloramphenicol	-	0	0	0	0	0	12,5	0	0	2,6
Florfenicol	-	0	0	0	0	0	12,5	0	0	0,0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0,0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0,0
Nalidixic acid	-	0	0	0	0	6,3	0	12,5	6,1	0,0
Ciprofloxacin	-	0	0	0	0	6,3	0	12,5	6,1	0,0
Ampicillin	-	0	0	7,7	0	0	0	12,5	0	2,6
Sulfamethoxazol	-	0	0	7,7	0	0	12,5	12,5	0	2,6
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	0,0
Tetracycline	-	0	0	7,7	0	0	0	12,5	0	2,6

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.77: Development of resistance rates in *S.* Enteritidis from cattle

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	10	17	20	46	13	27	28	24	45	11
Susceptible	40	88,2	90	95,7	100	100	96,4	95,8	100	72,7
Resistant	60	11,8	10	4,3	0	0	3,6	4,2	0	27,3
Multiresistant (2)	10	0	0	2,2	0	0	3,6	0	0	0,0
Gentamicin	0	0	10	0	0	0	0	0	0	0,0
Kanamycin	0	0	10	2,2	0	0	0	0	0	0,0
Streptomycin	0	0	0	0	0	0	3,6	4,2	0	0,0
Chloramphenicol	0	0	0	2,2	0	0	0	0	0	0,0
Florfenicol	0	0	0	2,2	0	0	0	0	0	0,0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0,0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0,0
Nalidixic acid	10	0	0	2,2	0	0	0	0	0	27,3
Ciprofloxacin	10	0	0	2,2	0	0	0	0	0	27,3
Ampicillin	0	0	0	0	0	0	3,6	0	0	0,0
Sulfamethoxazol	50	5,9	0	2,2	0	0	3,6	0	0	0,0
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	0,0
Tetracycline	0	0	0	0	0	0	3,6	0	0	0,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.2.2.3 Isolates from chicken

Tab. 20.78: Resistance rates in *Salmonella* spp. isolates from chicken

	Salmonella spp.	*S.* Enteritidis	*S.* 4,12:d:-	*S.* Typhimurium	*S.* Paratyphi BdT+	*S.* Infantis
Tested isolates	315	136	6	25	6	10
Susceptible	80,0	99,3	83,3	80,0	0,0	70,0
Resistant	20,0	0,7	16,7	20,0	100,0	30,0
Multiresistant (2)	15,9	0,0	0,0	16,0	100,0	20,0
Gentamicin	0,6	0,0	0,0	0,0	0,0	0,0
Kanamycin	1,9	0,0	0,0	0,0	16,7	0,0
Streptomycin	10,2	0,0	0,0	12,0	16,7	20,0
Chloramphenicol	1,6	0,0	0,0	12,0	0,0	0,0
Florfenicol	1,3	0,0	0,0	12,0	0,0	0,0
Cefotaxime (1)	0,0	0,0	0,0	0,0	0,0	0,0
Ceftazidime (1)	0,0	0,0	0,0	0,0	0,0	0,0
Nalidixic acid	8,3	0,0	0,0	8,0	83,3	0,0
Ciprofloxacin	8,6	0,0	0,0	8,0	83,3	0,0
Ampicillin	9,8	0,7	0,0	16,0	16,7	10,0
Sulfamethoxazol	11,7	0,0	16,7	16,0	16,7	20,0
Trimethoprim (1)	6,3	0,0	0,0	8,0	100,0	20,0
Tetracycline	10,8	0,0	0,0	20,0	16,7	0,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.79: Development of resistance rates in *Salmonella* spp. from chicken

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	341	455	300	372	539	199	149	208	364	315
Susceptible	26,4	37,1	65	63,7	60,3	57,8	59,7	83,2	85,4	80,0
Resistant	73,6	62,9	35	36,3	39,7	42,2	40,3	16,8	14,6	20,0
Multiresistant (2)	28,7	19,6	25,3	24,7	21,7	32,7	26,8	10,1	11,3	15,9
Gentamicin	2,1	0,4	0,7	1,9	0,4	0	2	3,4	0,5	0,6
Kanamycin	9,4	3,3	1	1,1	0,9	3	2,7	1,4	1,1	1,9
Streptomycin	10,6	5,7	8	11,3	10,8	10,6	11,4	2,9	4,7	10,2
Chloramphenicol	4,7	2,6	1,3	2,4	5,8	5	4	0,5	1,9	1,6
Florfenicol	1,2	0,7	0,7	2,2	4,8	3	1,3	0,5	1,6	1,3
Cefotaxime (1)	-	-	-	-	-	-	-	0	0,5	0,0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0,5	0,0
Nalidixic acid	3,2	10,1	24,3	23,9	9,6	22,6	21,5	9,1	4,4	8,3
Ciprofloxacin	3,2	7	24	23,9	10	24,6	20,8	9,1	4,4	8,6
Ampicillin	6,7	7,7	11,7	7,8	17,1	14,1	12,1	5,3	9,6	9,8
Sulfamethoxazol	70,7	56,5	16,7	24,7	26,7	17,6	21,5	6,3	9,1	11,7
Trimethoprim (1)	-	-	-	-	-	-	-	0	7,7	6,3
Tetracycline	17,6	6,8	5,3	17,2	12,6	11,6	27,5	7,2	3,6	10,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.80: Resistance rates in *S.* Enteritidis from chicken

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	67	111	113	67	54	41	40	98	140	136
Susceptible	38,8	59,5	77	79,1	66,7	92,7	100	85,7	98,6	99,3
Resistant	61,2	40,5	23	20,9	33,3	7,3	0	14,3	1,4	0,7
Multiresistant (2)	13,4	5,4	4,4	4,5	1,9	0	0	5,1	0	0
Gentamicin	6	0,9	1,8	1,5	0	0	0	4,1	0	0
Kanamycin	0	0	1,8	1,5	0	0	0	0	0	0
Streptomycin	7,5	0	5,3	3	1,9	0	0	1	0,7	0
Chloramphenicol	1,5	0,9	0	0	0	0	0	0	0	0
Florfenicol	0	0	0,9	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	1,5	9,9	14,2	16,4	31,5	4,9	0	9,2	0	0
Ciprofloxacin	1,5	9,9	14,2	16,4	31,5	7,3	0	9,2	0	0
Ampicillin	4,5	0,9	5,3	4,5	1,9	0	0	1	0,7	0,7
Sulfamethoxazol	58,2	33,3	3,5	1,5	0	0	0	5,1	0	0
Trimethoprim (1)	-	-	-	-	-	-	-	0	0	0
Tetracycline	4,5	0,9	1,8	1,5	0	0	0	4,1	0	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.81: Resistance rates in *S.* Typhimurium from chicken

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	32	47	18	15	49	26	15	22	15	25
Susceptible	6,3	8,5	72,2	26,7	16,3	65,4	53,3	86,4	66,7	80,0
Resistant	93,7	91,5	27,8	73,3	83,7	34,6	46,7	13,6	33,3	20,0
Multiresistant (2)	15,6	53,2	27,8	66,7	63,3	34,6	20	9,1	33,3	16,0
Gentamicin	0	0	0	0	0	0	0	0	0	0
Kanamycin	0	4,3	0	0	0	3,8	0	0	0	0
Streptomycin	12,5	19,1	27,8	60	59,2	34,6	20	4,5	33,3	12,0
Chloramphenicol	12,5	4,3	5,6	53,3	53,1	23,1	13,3	4,5	33,3	12,0
Florfenicol	12,5	2,1	5,6	53,3	53,1	23,1	13,3	4,5	33,3	12,0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	6,3	34	5,6	0	2	3,8	13,3	0	0	8,0
Ciprofloxacin	6,3	2,1	5,6	0	2	3,8	13,3	0	0	8,0
Ampicillin	12,5	8,5	22,2	60	63,3	26,9	13,3	9,1	33,3	16,0
Sulfamethoxazol	87,5	89,4	27,8	73,3	81,6	34,6	40	13,6	33,3	16,0
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	8,0
Tetracycline	12,5	19,1	22,2	60	59,2	30,8	13,3	9,1	33,3	20,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.82: Resistance rates in *S.* Paratyphi B dT+ from chicken

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	15	12	51	35	57	26	13	6	11	6
Susceptible	0	0	0	2,9	0	0	0	0	0	0
Resistant	100	100	100	97,1	100	100	100	100	100	100
Multiresistant (2)	93,3	66,7	100	80	66,7	80,8	100	100	100	100
Gentamicin	0	8,3	0	0	0	0	0	0	0	0
Kanamycin	0	0	0	5,7	3,5	0	7,7	0	9,1	16,7
Streptomycin	20	16,7	5,9	37,1	19,3	3,8	23,1	0	27,3	16,7
Chloramphenicol	6,7	0	0	0	3,5	0	7,7	0	0	0
Florfenicol	0	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	18,2	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	18,2	0
Nalidixic acid	0	58,3	100	68,6	15,8	76,9	69,2	100	81,8	83,3
Ciprofloxacin	0	58,3	100	71,4	19,3	80,8	69,2	100	81,8	83,3
Ampicillin	20	16,7	21,6	25,7	33,3	11,5	69,2	0	27,3	16,7
Sulfamethoxazol	80	58,3	54,9	71,4	59,6	30,8	84,6	0	27,3	16,7
Trimethoprim (1)	-	-	-	-	-	-	-	-	100	100
Tetracycline	6,7	0	0	28,6	10,5	0	23,1	16,7	0	16,7

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.83: Resistance rates in *S.* 4,12:d:- from chicken

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	75	154	2	32	115	2	6	8	70	6
Susceptible	30,7	25,3	100	100	81,7	50	83,3	87,5	100	83,3
Resistant	69,3	74,7	0	0	18,3	50	16,7	12,5	0	16,7
Multiresistant (2)	13,3	6,5	0	0	0	0	0	0	0	0
Gentamicin	1,3	0	0	0	0	0	0	0	0	0
Kanamycin	1,3	0	0	0	0	0	0	0	0	0
Streptomycin	0	2,6	0	0	0	0	0	0	0	0
Chloramphenicol	0	0	0	0	0	0	0	0	0	0
Florfenicol	0	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	0	0	0	0	0	0	0	0	0	0
Ciprofloxacin	1,3	0,6	0	0	0	50	0	0	0	0
Ampicillin	1,3	3,9	0	0	1,7	0	0	12,5	0	0
Sulfamethoxazol	68	74	0	0	16,5	0	16,7	0	0	16,7
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	0
Tetracycline	1,3	0	0	0	0	0	0	0	0	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.84: Resistance rates in *S.* Infantis from chicken

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	2	11	5	67	86	22	18	1	10	10,0
Susceptible	50	18,2	100	20,9	74,4	86,4	55,6	100	80	70,0
Resistant	50	81,8	0	79,1	25,6	13,6	44,4	0	20	30,0
Multiresistant (2)	0	81,8	0	61,2	16,3	9,1	44,4	0	10	20,0
Gentamicin	0	0	0	0	0	0	0	0	0	0
Kanamycin	0	0	0	0	0	4,5	0	0	0	0
Streptomycin	0	0	0	13,4	3,5	0	0	0	0	20,0
Chloramphenicol	0	0	0	0	0	4,5	0	0	0	0
Florfenicol	0	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	0	0	0	74,6	11,6	0	38,9	0	0	0
Ciprofloxacin	0	0	0	74,6	11,6	4,5	38,9	0	0	0
Ampicillin	0	81,8	0	3	11,6	4,5	5,6	0	10	10,0
Sulfamethoxazol	50	81,8	0	59,7	17,4	9,1	44,4	0	20	20,0
Trimethoprim (1)	-	-	-	-	-	-	-	-	20	20,0
Tetracycline	0	0	0	61,2	11,6	0	38,9	0	0	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.85: Resistance rates in *S.* 4,[5],12:i:- from chicken

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	0	1	2	1	6	12	2	4	5	12
Susceptible	-	0	50	100	0	58,3	0	75	40	8,3
Resistant		100	50	0	100	41,7	100	25	60	91,7
Multiresistant (2)	-	100	50	0	83,3	33,3	50	25	40	83,3
Gentamicin	-	0	0	0	0	0	0	0	0	0
Kanamycin	-	100	0	0	0	0	0	0	0	8,3
Streptomycin	-	100	50	0	83,3	25	50	25	40	91,7
Chloramphenicol	-	0	0	0	0	0	0	0	0	0
Florfenicol	-	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	-	0	0	0	16,7	0	50	0	20	0
Ciprofloxacin	-	0	0	0	16,7	0	0	0	20	0
Ampicillin	-	100	50	0	83,3	33,3	50	25	40	83,3
Sulfamethoxazol	-	100	50	0	83,3	33,3	50	25	40	83,3
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	0
Tetracycline	-	100	50	0	83,3	33,3	50	25	40	75,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.2.2.4 Isolates from turkeys

Tab. 20.86: Resistance rates in *Salmonella* isolates from turkeys

	Salmonella spp.	*S.* Typhimurium	*S.* Saintpaul	*S.* Heidelberg	*S.* Enteritidis	*S.* 4,[5],12:i:-
Tested isolates	87	19	31	5	1	4
Susceptible	23,0	36,8	0,0	0,0	100,0	0
Resistant	77,0	63,2	100,0	100,0	0,0	100
Multiresistant (2)	71,3	57,9	96,8	100,0	0,0	100
Gentamicin	26,4	5,3	61,3	0,0	0,0	0,0
Kanamycin	29,9	21,1	61,3	0,0	0,0	0,0
Streptomycin	33,3	21,1	58,1	0,0	0,0	100,0
Chloramphenicol	12,6	42,1	0,0	0,0	0,0	50,0
Florfenicol	2,3	5,3	0,0	0,0	0,0	25,0
Cefotaxime (1)	0,0	0,0	0,0	0,0	0,0	0,0
Ceftazidime (1)	0,0	0,0	0,0	0,0	0,0	0,0
Nalidixic acid	31,0	0,0	67,7	0,0	0,0	0,0
Ciprofloxacin	31,0	0,0	67,7	0,0	0,0	0,0
Ampicillin	57,5	36,8	77,4	100,0	0,0	100,0
Sulfamethoxazol	58,6	57,9	93,5	0,0	0,0	100,0
Trimethoprim (1)	17,2	10,5	32,3	0,0	0,0	0,0
Tetracycline	47,1	26,3	54,8	100,0	0,0	100,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.87: Resistance rates in *Salmonella* spp. from turkeys

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	48	179	318	172	108	117	141	80	72	87
Susceptible	27,1	21,2	33,6	27,9	24,1	31,6	27,7	35	27,8	23,0
Resistant	72,9	78,8	66,4	72,1	75,9	68,4	72,3	65	72,2	77,0
Multiresistant (2)	31,3	53,1	59,7	65,1	58,3	49,6	63,1	53,8	69,4	71,3
Gentamicin	8,3	7,3	41,5	40,1	11,1	8,5	11,3	30	44,4	26,4
Kanamycin	12,5	14	39,3	41,9	13,9	20,5	12,8	32,5	44,4	29,9
Streptomycin	16,7	27,4	38,7	45,9	46,3	26,5	41,1	33,8	18,1	33,3
Chloramphenicol	12,5	27,9	12,6	11,6	35,2	13,7	5	6,3	5,6	12,6
Florfenicol	2,1	19	4,7	4,7	29,6	9,4	1,4	6,3	4,2	2,3
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	12,5	2,8	42,5	37,2	15,7	17,1	12,1	33,8	43,1	31,0
Ciprofloxacin	12,5	5	43,1	40,1	16,7	24,8	12,8	33,8	43,1	31,0
Ampicillin	16,7	35,2	52,8	56,4	57,4	45,3	44	45	62,5	57,5
Sulfamethoxazol	70,8	74,9	55,3	61	63	45,3	29,8	42,5	62,5	58,6
Trimethoprim (1)	-	-	-	-	-	-	-	0	12,5	17,2
Tetracycline	16,7	34,1	19,2	28,5	48,1	29,9	64,5	30	30,6	47,1

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.88: Resistance rates in *S.* Enteritidis from turkeys

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	14	9	9	2	8	8	4	8	2	1
Susceptible	42,9	88,9	88,9	100	87,5	100	100	100	100	100
Resistant	57,1	11,1	11,1	0	12,5	0	0	0	0	0
Multiresistant (2)	28,6	0	0	0	0	0	0	0	0	0
Gentamicin	7,1	0	0	0	0	0	0	0	0	0
Kanamycin	7,1	0	0	0	0	0	0	0	0	0
Streptomycin	7,1	0	0	0	0	0	0	0	0	0
Chloramphenicol	7,1	0	0	0	0	0	0	0	0	0
Florfenicol	0	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	14,3	11,1	0	0	0	0	0	0	0	0
Ciprofloxacin	14,3	11,1	0	0	0	0	0	0	0	0
Ampicillin	0	0	0	0	0	0	0	0	0	0
Sulfamethoxazol	57,1	0	0	0	0	0	0	0	0	0
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	0
Tetracycline	0	0	0	0	12,5	0	0	0	0	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.89: Resistance rates in *S.* Saintpaul from turkeys

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	0	4	115	53	11	29	18	25	30	31
Susceptible	-	25	0	0	0	34,5	0	0	3,3	0
Resistant	-	75	100	100	100	65,5	100	100	96,7	100,0
Multiresistant (2)	-	75	99,1	100	90,9	48,3	100	96	93,3	96,8
Gentamicin	-	0	93,9	96,2	72,7	24,1	72,2	92	93,3	61,3
Kanamycin	-	0	93,9	96,2	81,8	37,9	72,2	92	93,3	61,3
Streptomycin	-	75	71,3	81,1	81,8	24,1	55,6	36	16,7	58,1
Chloramphenicol	-	0	9,6	13,2	18,2	0	11,1	4	3,3	0
Florfenicol	-	0	3,5	9,4	0	0	0	4	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	-	0	97,4	96,2	81,8	24,1	72,2	84	90	67,7
Ciprofloxacin	-	0	97,4	96,2	81,8	24,1	72,2	84	90	67,7
Ampicillin	-	75	98,3	100	90,9	51,7	100	100	93,3	77,4
Sulfamethoxazol	-	75	96,5	100	90,9	51,7	100	96	93,3	93,5
Trimethoprim (1)	-	-	-	-	-	-	-	0	6,7	32,3
Tetracycline	-	75	7,8	17	45,5	34,5	44,4	12	6,7	54,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.90: Resistance rates in *S.* Heidelberg from turkeys

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	10	44	69	37	7	3	15	1	0	5
Susceptible	30	18,2	33,3	27	42,9	0	26,7	100	-	0
Resistant	70	81,8	66,7	73	57,1	100	73,3	0	-	100
Multiresistant (2)	40	65,9	55,1	67,6	57,1	66,7	73,3	0	-	100
Gentamicin	10	13,6	20,3	29,7	0	0	0	0	-	0
Kanamycin	10	27,3	11,6	29,7	14,3	33,3	0	0	-	0
Streptomycin	30	29,6	26,1	40,5	14,3	0	0	0	-	0
Chloramphenicol	0	36,4	23,2	16,2	14,3	66,7	0	0	-	0
Florfenicol	0	18,2	2,9	2,7	0	0	0	0	-	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	-	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	-	0
Nalidixic acid	0	0	0	0	0	0	0	0	-	0
Ciprofloxacin	0	4,5	2,9	2,7	0	0	0	0	-	0
Ampicillin	30	40,9	33,3	37,8	57,1	100	73,3	0	-	100
Sulfamethoxazol	70	75	46,4	62,2	57,1	66,7	0	0	-	0
Trimethoprim (1)	-	-	-	-	-	-	-	-	-	0
Tetracycline	30	25	42	35,1	42,9	66,7	73,3	0	-	100

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.91: Resistance rates in *S.* Typhimurium from turkeys

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	1	30	15	16	34	12	13	7	5	19
Susceptible	0	0	13,3	0	0	8,3	76,9	42,9	0	36,8
Resistant	100	100	86,7	100	100	91,7	23,1	57,1	100	63,2
Multiresistant (2)	0	93,3	80	100	94,1	91,7	23,1	57,1	80	57,9
Gentamicin	0	3,3	0	0	0	0	0	0	0	5,3
Kanamycin	0	0	0	18,8	0	25	7,7	14,3	0	21,1
Streptomycin	0	83,3	66,7	68,8	91,2	91,7	23,1	57,1	60	21,1
Chloramphenicol	0	73,3	53,3	31,3	91,2	83,3	15,4	57,1	40	42,1
Florfenicol	0	73,3	53,3	12,5	88,2	83,3	15,4	57,1	40	5,3
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	0	0	0	0	0	0	0	0	20	0
Ciprofloxacin	0	0	0	0	0	8,3	0	0	20	0
Ampicillin	0	86,7	73,3	100	94,1	91,7	23,1	57,1	80	36,8
Sulfamethoxazol	100	100	80	100	100	91,7	23,1	57,1	100	57,9
Trimethoprim (1)	-	-	-	-	-	-	-	0	0	10,5
Tetracycline	0	90	66,7	87,5	94,1	91,7	23,1	57,1	80	26,3

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.2.3 Distribution of MIC values in Salmonella isolates from animals

20.2.3.1 Isolates from pigs

Tab. 20.92: *Salmonella* spp. from pigs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	343	16	4,7						70,8	22,4	2,0	0,0	0,6	1,2	1,7	0,9	0,3					
Kanamycin	343	33	9,6										88,0	2,3	0,3	0,0	0,0	0,0	9,3			
Streptomycin	343	240	70,0									0,6	4,1	15,5	7,9	2,0	14,0	15,5	40,5			
Chloramphenicol	343	73	21,3									1,2	22,2	53,4	2,0	0,0	0,3	21,0				
Florfenicol	343	58	16,9									1,7	56,6	23,0	1,7	5,8	4,7	6,4				
Cefotaxime	343	7	2,0				36,7	46,6	13,7	0,9	0,0	0,0	0,0	2,0								
Ceftazidime	343	6	1,7						54,2	37,9	5,5	0,6	0,6	0,9	0,0	0,3						
Nalidixic acid	343	6	1,7										92,7	5,0	0,6	0,0	0,3	1,5				
Ciprofloxacin	343	9	2,6	0,0	7,9	74,6	14,9	0,6	1,5	0,3	0,0	0,3	0,0	0,0	0,0							
Ampicillin	343	252	73,5							1,5	16,6	8,2	0,3	0,0	0,0	0,0	73,5					
Colistin (1)	343													100,0	0,0	0,0						
Sulfamethoxazole	343	255	74,3											0,0	0,6	2,0	20,1	2,9	0,0	0,0	0,3	74,1
Trimethoprim	343	79	23,0							75,8	1,2	0,0	0,3	0,0	0,0	0,0	22,7					
Tetracycline	343	233	67,9								3,8	24,2	4,1	0,0	0,6	8,5	6,7	52,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

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Tab. 20.93: *S.* 4,[5],12:i:- from pigs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	110	4	3,6						75,5	18,2	2,7	0,0	1,8	0,0	0,9	0,9	0,0					
Kanamycin	110	7	6,4										90,9	2,7	0,0	0,0	0,0	0,0	6,4			
Streptomycin	110	103	93,6									0,0	0,0	2,7	3,6	0,0	0,9	17,3	75,5			
Chloramphenicol	110	5	4,5									1,8	28,2	63,6	1,8	0,0	0,0	4,5				
Florfenicol	110	3	2,7									2,7	61,8	30,0	2,7	0,0	0,0	2,7				
Cefotaxime	110	2	1,8				41,8	45,5	10,0	0,9	0,0	0,0	0,0	1,8								
Ceftazidime	110	2	1,8						58,2	37,3	2,7	0,0	0,9	0,9	0,0	0,0						
Nalidixic acid	110	0	0,0										90,9	8,2	0,9	0,0	0,0	0,0				
Ciprofloxacin	110	1	0,9	0,0	2,7	75,5	20,9	0,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	110	103	93,6							0,9	1,8	2,7	0,9	0,0	0,0	0,0	93,6					
Colistin (1)	110													100,0	0,0	0,0						
Sulfamethoxazole	110	103	93,6											0,0	0,0	1,8	4,5	0,0	0,0	0,0	0,9	92,7
Trimethoprim	110	12	10,9							88,2	0,9	0,0	0,0	0,0	0,0	0,0	10,9					
Tetracycline	110	92	83,6								2,7	10,0	3,6	0,0	0,0	0,0	0,0	83,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.94: 13.133: *S.* Derby from pigs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	20	1	5,0						55,0	40,0	0,0	0,0	0,0	0,0	5,0	0,0	0,0					
Kanamycin	20	0	0,0										95,0	5,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	20	6	30,0									0,0	5,0	35,0	25,0	5,0	0,0	25,0	5,0			
Chloramphenicol	20	0	0,0									0,0	20,0	75,0	5,0	0,0	0,0	0,0				
Florfenicol	20	0	0,0									0,0	55,0	40,0	5,0	0,0	0,0	0,0				
Cefotaxime	20	0	0,0				5,0	65,0	25,0	5,0	0,0	0,0	0,0	0,0								
Ceftazidime	20	0	0,0						10,0	65,0	25,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	20	0	0,0										95,0	5,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	20	0	0,0	0,0	20,0	60,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	20	5	25,0							5,0	45,0	25,0	0,0	0,0	0,0	0,0	25,0					
Colistin (1)	20													100,0	0,0	0,0						
Sulfamethoxazole	20	7	35,0											0,0	0,0	15,0	50,0	0,0	0,0	0,0	0,0	35,0
Trimethoprim	20	5	25,0							75,0	0,0	0,0	0,0	0,0	0,0	0,0	25,0					
Tetracycline	20	7	35,0								5,0	50,0	10,0	0,0	0,0	0,0	0,0	35,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.95: *S.* Enteritidis from pigs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
				Distribution (%) of MICs (µg/ml) (3)																		
Gentamicin	8	0	0,0						62,5	25,0	12,5	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	8	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	8	1	12,5									25,0	37,5	25,0	0,0	0,0	0,0	0,0	12,5			
Chloramphenicol	8	0	0,0									0,0	62,5	37,5	0,0	0,0	0,0	0,0				
Florfenicol	8	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	8	0	0,0				25,0	75,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	8	0	0,0						62,5	37,5	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	8	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	8	0	0,0	0,0	0,0	75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	8	1	12,5							0,0	37,5	50,0	0,0	0,0	0,0	0,0	12,5					
Colistin (1)	8													100,0	0,0	0,0						
Sulfamethoxazole	8	1	12,5											0,0	0,0	0,0	87,5	0,0	0,0	0,0	0,0	12,5
Trimethoprim	8	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	8	1	12,5								12,5	75,0	0,0	0,0	0,0	0,0	0,0	12,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.96: *S.* Typhimurium from pigs (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
				Distribution (%) of MICs (µg/ml) (3)																		
Gentamicin	155	4	2,6						69,0	26,5	1,9	0,0	0,0	0,6	1,9	0,0	0,0					
Kanamycin	155	21	13,5										85,8	0,6	0,0	0,0	0,0	0,0	13,5			
Streptomycin	155	113	72,9									0,0	2,6	14,2	7,1	3,2	28,4	15,5	29,0			
Chloramphenicol	155	63	40,6									0,6	15,5	40,6	2,6	0,0	0,6	40,0				
Florfenicol	155	53	34,2									0,6	45,8	18,1	1,3	12,9	10,3	11,0				
Cefotaxime	155	2	1,3				40,0	41,9	16,1	0,6	0,0	0,0	0,0	1,3								
Ceftazidime	155	2	1,3						60,6	33,5	4,5	0,0	0,6	0,6	0,0	0,0						
Nalidixic acid	155	1	0,6										95,5	3,9	0,0	0,0	0,0	0,6				
Ciprofloxacin	155	2	1,3	0,0	7,7	78,1	12,9	0,6	0,6	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	155	128	82,6							0,0	10,3	7,1	0,0	0,0	0,0	0,0	82,6					
Colistin (1)	155													100,0	0,0	0,0						
Sulfamethoxazole	155	128	82,6											0,0	0,0	0,0	14,8	2,6	0,0	0,0	0,0	82,6
Trimethoprim	155	50	32,3							65,8	1,9	0,0	0,6	0,0	0,0	0,0	31,6					
Tetracycline	155	118	76,1								0,0	20,6	3,2	0,0	1,3	18,7	12,9	43,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.2.3.2 Isolates from cattle

Tab. 20.97: *Salmonella* spp. from cattle (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	221	0	0,0						81,0	15,8	2,7	0,5	0,0	0,0	0,0	0,0	0,0					
Kanamycin	221	6	2,7										96,8	0,5	0,0	0,0	0,0	0,0	2,7			
Streptomycin	221	103	46,6									2,7	4,1	29,4	12,2	5,0	7,7	14,9	24,0			
Chloramphenicol	221	23	10,4									0,5	37,1	51,1	0,9	0,0	0,0	10,4				
Florfenicol	221	22	10,0									4,5	58,4	27,1	0,0	3,6	2,7	3,6				
Cefotaxime	221	2	0,9				60,2	34,4	3,6	0,9	0,0	0,0	0,0	0,9								
Ceftazidime	221	2	0,9						76,0	21,3	1,4	0,5	0,5	0,5	0,0	0,0						
Nalidixic acid	221	15	6,8										89,6	2,7	0,9	0,0	0,9	5,9				
Ciprofloxacin	221	16	7,2	0,0	19,9	66,1	6,3	0,9	1,8	4,5	0,0	0,0	0,0	0,0	0,0							
Ampicillin	221	99	44,8							13,6	29,0	12,7	0,0	0,0	0,0	0,0	44,8					
Colistin (1)	221													99,5	0,5	0,0						
Sulfamethoxazole	221	106	48,0											1,8	5,9	12,2	27,6	4,1	0,5	0,0	0,0	48,0
Trimethoprim	221	10	4,5							94,6	0,9	0,0	0,0	0,0	0,0	0,0	4,5					
Tetracycline	221	99	44,8								13,1	38,9	3,2	0,0	0,0	6,3	2,7	35,7				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.98: *S.* 4,[5],12:i:- from cattle (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	67	0	0,0						82,1	14,9	3,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	67	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	67	65	97,0									0,0	1,5	1,5	0,0	0,0	0,0	32,8	64,2			
Chloramphenicol	67	0	0,0									0,0	17,9	82,1	0,0	0,0	0,0	0,0				
Florfenicol	67	0	0,0									0,0	52,2	47,8	0,0	0,0	0,0	0,0				
Cefotaxime	67	1	1,5				67,2	29,9	1,5	0,0	0,0	0,0	0,0	1,5								
Ceftazidime	67	1	1,5						86,6	11,9	0,0	0,0	1,5	0,0	0,0	0,0						
Nalidixic acid	67	5	7,5										88,1	4,5	0,0	0,0	0,0	7,5				
Ciprofloxacin	67	5	7,5	0,0	7,5	82,1	3,0	0,0	0,0	7,5	0,0	0,0	0,0	0,0	0,0							
Ampicillin	67	65	97,0							0,0	3,0	0,0	0,0	0,0	0,0	0,0	97,0					
Colistin (1)	67													100,0	0,0	0,0						
Sulfamethoxazole	67	65	97,0											0,0	0,0	0,0	3,0	0,0	0,0	0,0	0,0	97,0
Trimethoprim	67	1	1,5							98,5	0,0	0,0	0,0	0,0	0,0	0,0	1,5					
Tetracycline	67	62	92,5								0,0	7,5	0,0	0,0	0,0	0,0	0,0	92,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

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Tab. 20.99: *S.* Anatum from cattle (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	4	0	0,0						25,0	25,0	25,0	25,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	4	0	0,0										75,0	25,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	4	1	25,0									0,0	0,0	50,0	0,0	25,0	25,0	0,0	0,0			
Chloramphenicol	4	0	0,0									0,0	75,0	25,0	0,0	0,0	0,0	0,0				
Florfenicol	4	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	4	0	0,0				25,0	75,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	4	0	0,0						0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	4	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	4	0	0,0	0,0	25,0	50,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	4	0	0,0							25,0	75,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	4													100,0	0,0	0,0						
Sulfamethoxazole	4	0	0,0											0,0	0,0	25,0	50,0	0,0	25,0	0,0	0,0	0,0
Trimethoprim	4	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	4	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.100: *S.* Dublin from cattle (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	39	0	0,0						89,7	10,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	39	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	39	0	0,0									0,0	2,6	56,4	30,8	10,3	0,0	0,0	0,0			
Chloramphenicol	39	1	2,6									0,0	89,7	7,7	0,0	0,0	0,0	2,6				
Florfenicol	39	0	0,0									7,7	87,2	5,1	0,0	0,0	0,0	0,0				
Cefotaxime	39	0	0,0				87,2	10,3	2,6	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	39	0	0,0						89,7	10,3	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	39	0	0,0										97,4	2,6	0,0	0,0	0,0	0,0				
Ciprofloxacin	39	0	0,0	0,0	41,0	51,3	7,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	39	1	2,6							48,7	41,0	7,7	0,0	0,0	0,0	0,0	2,6					
Colistin (1)	39													100,0	0,0	0,0						
Sulfamethoxazole	39	1	2,6											5,1	23,1	35,9	33,3	0,0	0,0	0,0	0,0	2,6
Trimethoprim	39	0	0,0							97,4	2,6	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	39	1	2,6								35,9	59,0	2,6	0,0	0,0	0,0	0,0	2,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

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Tab. 20.101: *S.* Enteritidis from cattle (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	11	0	0,0						63,6	36,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	11	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	11	0	0,0									54,5	36,4	9,1	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	11	0	0,0									0,0	72,7	27,3	0,0	0,0	0,0	0,0				
Florfenicol	11	0	0,0									18,2	81,8	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	11	0	0,0				45,5	54,5	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	11	0	0,0						81,8	18,2	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	11	3	27,3										72,7	0,0	0,0	0,0	18,2	9,1				
Ciprofloxacin	11	3	27,3	0,0	18,2	54,5	0,0	18,2	9,1	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	11	0	0,0							27,3	45,5	27,3	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	11													100,0	0,0	0,0						
Sulfamethoxazole	11	0	0,0											0,0	9,1	45,5	45,5	0,0	0,0	0,0	0,0	0,0
Trimethoprim	11	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	11	0	0,0								54,5	45,5	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.102: *S.* Typhimurium from cattle (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	69	0	0,0						75,4	23,2	1,4	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	69	6	8,7										91,3	0,0	0,0	0,0	0,0	0,0	8,7			
Streptomycin	69	35	50,7									0,0	2,9	33,3	8,7	4,3	21,7	14,5	14,5			
Chloramphenicol	69	21	30,4									0,0	14,5	53,6	1,4	0,0	0,0	30,4				
Florfenicol	69	21	30,4									0,0	43,5	26,1	0,0	11,6	7,2	11,6				
Cefotaxime	69	0	0,0				50,7	40,6	7,2	1,4	0,0	0,0	0,0	0,0								
Ceftazidime	69	0	0,0						72,5	23,2	4,3	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	69	7	10,1										85,5	2,9	1,4	0,0	0,0	10,1				
Ciprofloxacin	69	7	10,1	0,0	17,4	65,2	7,2	0,0	4,3	5,8	0,0	0,0	0,0	0,0	0,0							
Ampicillin	69	30	43,5							1,4	31,9	23,2	0,0	0,0	0,0	0,0	43,5					
Colistin (1)	69													98,6	1,4	0,0						
Sulfamethoxazole	69	37	53,6											0,0	2,9	0,0	34,8	8,7	0,0	0,0	0,0	53,6
Trimethoprim	69	8	11,6							87,0	1,4	0,0	0,0	0,0	0,0	0,0	11,6					
Tetracycline	69	33	47,8								0,0	43,5	8,7	0,0	0,0	18,8	8,7	20,3				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.2.3.3 Isolates from chicken

Tab. 20.103: *Salmonella* spp. from chicken (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	315	2	0,6						79,4	19,0	0,6	0,3	0,0	0,6	0,0	0,0	0,0					
Kanamycin	315	6	1,9										97,5	0,6	0,0	0,0	0,3	0,0	1,6			
Streptomycin	315	32	10,2									30,2	22,9	21,3	10,2	5,4	4,8	2,9	2,5			
Chloramphenicol	315	5	1,6									1,6	47,9	48,6	0,3	0,0	0,0	1,6				
Florfenicol	315	4	1,3									3,2	79,7	15,9	0,0	0,3	1,0	0,0				
Cefotaxime	315	0	0,0				37,5	51,7	10,2	0,6	0,0	0,0	0,0	0,0								
Ceftazidime	315	0	0,0						57,5	36,5	5,7	0,3	0,0	0,0	0,0	0,0						
Nalidixic acid	315	26	8,3										89,2	2,2	0,3	0,0	1,0	7,3				
Ciprofloxacin	315	27	8,6	0,0	12,4	67,9	11,1	0,3	4,8	2,9	0,3	0,3	0,0	0,0	0,0							
Ampicillin	315	31	9,8							4,1	56,8	28,6	0,6	0,0	0,0	0,0	9,8					
Colistin (1)	315													100,0	0,0	0,0						
Sulfamethoxazole	315	37	11,7											1,0	1,9	22,5	54,0	8,3	0,6	0,0	0,0	11,4
Trimethoprim	315	20	6,3							92,4	1,3	0,0	0,0	0,0	0,0	0,0	6,3					
Tetracycline	315	34	10,8								11,7	72,7	4,8	0,0	0,0	0,6	3,2	7,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.104: *S.* 4,[5],12:i:- from chicken (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	12	0	0,0						75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	12	1	8,3										91,7	0,0	0,0	0,0	0,0	0,0	8,3			
Streptomycin	12	11	91,7									0,0	0,0	0,0	8,3	0,0	16,7	50,0	25,0			
Chloramphenicol	12	0	0,0									0,0	16,7	83,3	0,0	0,0	0,0	0,0				
Florfenicol	12	0	0,0									0,0	66,7	33,3	0,0	0,0	0,0	0,0				
Cefotaxime	12	0	0,0				41,7	41,7	16,7	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	12	0	0,0						50,0	41,7	8,3	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	12	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	12	0	0,0	0,0	8,3	50,0	41,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	12	10	83,3							0,0	0,0	16,7	0,0	0,0	0,0	0,0	83,3					
Colistin (1)	12													100,0	0,0	0,0						
Sulfamethoxazole	12	10	83,3											0,0	0,0	0,0	16,7	0,0	0,0	0,0	0,0	83,3
Trimethoprim	12	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	12	9	75,0								0,0	16,7	8,3	0,0	0,0	0,0	0,0	75,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.105: *S.* Enteritidis from chicken (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	136	0	0,0						86,0	14,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	136	0	0,0										99,3	0,7	0,0	0,0	0,0	0,0	0,0			
Streptomycin	136	0	0,0									61,8	33,1	5,1	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	136	0	0,0									0,7	60,3	39,0	0,0	0,0	0,0	0,0				
Florfenicol	136	0	0,0									2,9	91,9	5,1	0,0	0,0	0,0	0,0				
Cefotaxime	136	0	0,0				45,6	52,9	1,5	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	136	0	0,0						79,4	20,6	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	136	0	0,0										98,5	1,5	0,0	0,0	0,0	0,0				
Ciprofloxacin	136	0	0,0	0,0	11,0	80,9	8,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	136	1	0,7							1,5	70,6	27,2	0,0	0,0	0,0	0,0	0,7					
Colistin (1)	136													100,0	0,0	0,0						
Sulfamethoxazole	136	0	0,0											0,0	2,2	14,7	77,2	5,9	0,0	0,0	0,0	0,0
Trimethoprim	136	0	0,0							99,3	0,7	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	136	0	0,0								11,0	86,8	2,2	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.106: *S.* Infantis from chicken (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	10	0	0,0						90,0	10,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	10	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	10	2	20,0									0,0	10,0	70,0	0,0	0,0	10,0	0,0	10,0			
Chloramphenicol	10	0	0,0									0,0	20,0	80,0	0,0	0,0	0,0	0,0				
Florfenicol	10	0	0,0									0,0	50,0	50,0	0,0	0,0	0,0	0,0				
Cefotaxime	10	0	0,0				0,0	80,0	20,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	10	0	0,0						30,0	70,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	10	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	10	0	0,0	0,0	10,0	90,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	10	1	10,0							0,0	70,0	20,0	0,0	0,0	0,0	0,0	10,0					
Colistin (1)	10													100,0	0,0	0,0						
Sulfamethoxazole	10	2	20,0											0,0	0,0	20,0	60,0	0,0	0,0	0,0	0,0	20,0
Trimethoprim	10	2	20,0							80,0	0,0	0,0	0,0	0,0	0,0	0,0	20,0					
Tetracycline	10	0	0,0								10,0	90,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.107: *S.* Paratyphi B dT+ from chicken (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	6	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	6	1	16,7										83,3	0,0	0,0	0,0	0,0	0,0	16,7			
Streptomycin	6	1	16,7									0,0	0,0	0,0	50,0	33,3	0,0	16,7	0,0			
Chloramphenicol	6	0	0,0									0,0	66,7	33,3	0,0	0,0	0,0	0,0				
Florfenicol	6	0	0,0									0,0	83,3	16,7	0,0	0,0	0,0	0,0				
Cefotaxime	6	0	0,0				16,7	50,0	33,3	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	6	0	0,0						0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	6	5	83,3										16,7	0,0	0,0	0,0	0,0	83,3				
Ciprofloxacin	6	5	83,3	0,0	0,0	16,7	0,0	0,0	66,7	0,0	16,7	0,0	0,0	0,0	0,0							
Ampicillin	6	1	16,7							0,0	33,3	33,3	16,7	0,0	0,0	0,0	16,7					
Colistin (1)	6													100,0	0,0	0,0						
Sulfamethoxazole	6	1	16,7											16,7	16,7	50,0	0,0	0,0	0,0	0,0	0,0	16,7
Trimethoprim	6	6	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Tetracycline	6	1	16,7								83,3	0,0	0,0	0,0	0,0	0,0	0,0	16,7				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.108: *S.* Typhimurium from chicken (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	25	0	0,0						80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	25	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	25	3	12,0									0,0	8,0	56,0	20,0	4,0	8,0	4,0	0,0			
Chloramphenicol	25	3	12,0									0,0	20,0	68,0	0,0	0,0	0,0	12,0				
Florfenicol	25	3	12,0									0,0	52,0	36,0	0,0	0,0	12,0	0,0				
Cefotaxime	25	0	0,0				44,0	52,0	4,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	25	0	0,0						48,0	48,0	4,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	25	2	8,0										80,0	12,0	0,0	0,0	0,0	8,0				
Ciprofloxacin	25	2	8,0	0,0	8,0	52,0	32,0	0,0	4,0	4,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	25	4	16,0							0,0	52,0	32,0	0,0	0,0	0,0	0,0	16,0					
Colistin (1)	25													100,0	0,0	0,0						
Sulfamethoxazole	25	4	16,0											4,0	0,0	32,0	44,0	4,0	0,0	0,0	0,0	16,0
Trimethoprim	25	2	8,0							88,0	4,0	0,0	0,0	0,0	0,0	0,0	8,0					
Tetracycline	25	5	20,0								8,0	52,0	20,0	0,0	0,0	8,0	4,0	8,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.2.3.4 Isolates from turkeys

Tab. 20.109: *Salmonella* spp. from turkeys (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	87	23	26,4						52,9	20,7	0,0	0,0	0,0	17,2	6,9	1,1	1,1					
Kanamycin	87	26	29,9										67,8	2,3	1,1	14,9	1,1	1,1	11,5			
Streptomycin	87	29	33,3									1,1	1,1	24,1	17,2	23,0	14,9	6,9	11,5			
Chloramphenicol	87	11	12,6									2,3	19,5	52,9	12,6	1,1	0,0	11,5				
Florfenicol	87	2	2,3									2,3	49,4	25,3	20,7	0,0	2,3	0,0				
Cefotaxime	87	0	0,0				29,9	40,2	24,1	5,7	0,0	0,0	0,0	0,0								
Ceftazidime	87	0	0,0						37,9	43,7	17,2	1,1	0,0	0,0	0,0	0,0						
Nalidixic acid	87	27	31,0										67,8	1,1	0,0	1,1	1,1	28,7				
Ciprofloxacin	87	27	31,0	0,0	6,9	55,2	6,9	0,0	10,3	1,1	14,9	4,6	0,0	0,0	0,0							
Ampicillin	87	50	57,5							4,6	20,7	12,6	4,6	0,0	0,0	0,0	57,5					
Colistin (1)	87													100,0	0,0	0,0						
Sulfamethoxazole	87	51	58,6											1,1	3,4	11,5	18,4	6,9	0,0	0,0	0,0	58,6
Trimethoprim	87	15	17,2							75,9	5,7	1,1	0,0	0,0	0,0	0,0	17,2					
Tetracycline	87	41	47,1								0,0	33,3	18,4	1,1	0,0	3,4	8,0	35,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.110: *S.* 4,[5],12:i:- from turkeys (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	4	0	0,0						50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	4	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	4	4	100,0									0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0			
Chloramphenicol	4	2	50,0									0,0	25,0	25,0	0,0	0,0	0,0	50,0				
Florfenicol	4	1	25,0									0,0	25,0	25,0	25,0	0,0	25,0	0,0				
Cefotaxime	4	0	0,0				25,0	0,0	75,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	4	0	0,0						25,0	50,0	25,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	4	0	0,0										75,0	25,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	4	0	0,0	0,0	0,0	50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	4	4	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	4													100,0	0,0	0,0						
Sulfamethoxazole	4	4	100,0											0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0
Trimethoprim	4	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	4	4	100,0								0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.111: *S.* 4,12:d:- from turkeys (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	1	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Florfenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	1	0	0,0				0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	1	0	0,0						0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	1	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	1	1	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	1													100,0	0,0	0,0						
Sulfamethoxazole	1	0	0,0											0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	1	1	100,0								0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.112: *S.* Enteritidis from turkeys (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	1	0	0,0									100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	1	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	1	0	0,0				100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	1	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	1	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	1													100,0	0,0	0,0						
Sulfamethoxazole	1	0	0,0											0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	1	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.113: *S.* Heidelberg from turkeys (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	0	0,0						40,0	60,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	5	0	0,0									0,0	0,0	20,0	0,0	80,0	0,0	0,0	0,0			
Chloramphenicol	5	0	0,0									0,0	80,0	20,0	0,0	0,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				0,0	60,0	40,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	5	0	0,0	0,0	0,0	80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	5	5	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	0	0,0											0,0	0,0	60,0	40,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	5	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	5	5	100,0								0,0	0,0	0,0	0,0	0,0	0,0	60,0	40,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.114: *S.* Saintpaul from turkeys (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	31	19	61,3						29,0	9,7	0,0	0,0	0,0	48,4	12,9	0,0	0,0					
Kanamycin	31	19	61,3										38,7	0,0	3,2	38,7	3,2	0,0	16,1			
Streptomycin	31	18	58,1									0,0	0,0	0,0	6,5	35,5	35,5	9,7	12,9			
Chloramphenicol	31	0	0,0									3,2	0,0	67,7	29,0	0,0	0,0	0,0				
Florfenicol	31	0	0,0									3,2	29,0	41,9	25,8	0,0	0,0	0,0				
Cefotaxime	31	0	0,0				29,0	19,4	35,5	16,1	0,0	0,0	0,0	0,0								
Ceftazidime	31	0	0,0						35,5	32,3	29,0	3,2	0,0	0,0	0,0	0,0						
Nalidixic acid	31	21	67,7										32,3	0,0	0,0	0,0	3,2	64,5				
Ciprofloxacin	31	21	67,7	0,0	0,0	32,3	0,0	0,0	16,1	0,0	38,7	12,9	0,0	0,0	0,0							
Ampicillin	31	24	77,4							0,0	16,1	0,0	6,5	0,0	0,0	0,0	77,4					
Colistin (1)	31													100,0	0,0	0,0						
Sulfamethoxazole	31	29	93,5											0,0	0,0	0,0	3,2	3,2	0,0	0,0	0,0	93,5
Trimethoprim	31	10	32,3							48,4	16,1	3,2	0,0	0,0	0,0	0,0	32,3					
Tetracycline	31	17	54,8								0,0	0,0	41,9	3,2	0,0	3,2	6,5	45,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.115: *S.* Typhimurium from turkeys (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	19	1	5,3						57,9	36,8	0,0	0,0	0,0	0,0	0,0	0,0	5,3					
Kanamycin	19	4	21,1										73,7	5,3	0,0	0,0	0,0	0,0	21,1			
Streptomycin	19	4	21,1									0,0	0,0	21,1	36,8	21,1	5,3	5,3	10,5			
Chloramphenicol	19	8	42,1									0,0	15,8	42,1	0,0	0,0	0,0	42,1				
Florfenicol	19	1	5,3									0,0	52,6	5,3	36,8	0,0	5,3	0,0				
Cefotaxime	19	0	0,0				31,6	68,4	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	19	0	0,0						52,6	47,4	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	19	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	19	0	0,0	0,0	5,3	89,5	5,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	19	7	36,8							0,0	21,1	42,1	0,0	0,0	0,0	0,0	36,8					
Colistin (1)	19													100,0	0,0	0,0						
Sulfamethoxazole	19	11	57,9											0,0	0,0	0,0	31,6	10,5	0,0	0,0	0,0	57,9
Trimethoprim	19	2	10,5							89,5	0,0	0,0	0,0	0,0	0,0	0,0	10,5					
Tetracycline	19	5	26,3								0,0	68,4	5,3	0,0	0,0	5,3	0,0	21,1				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.3 *Salmonella* isolates from food

20.3.1 Distribution of the serovars from food

Tab. 20.116: The ten most frequent serovars of meat and the main meat categories (2009)

	Minced meat		Chicken meat		Turkey meat		Pork		Meat	
	N	%	N	%	N	%	N	%	N	%
	102	100	171	100	78	100	148	100	727	100
S. Typhimurium	25	24,5	23	13,5	5	6,4	53	35,8	176	24,2
S. 4,[5],12:i:-	29	28,4	19	11,1	15	19,2	38	25,7	152	20,9
S. Enteritidis	1	1,0	33	19,3	2	2,6	1	0,7	51	7,0
S. Derby	14	13,7	0	0	0	0	13	8,8	48	6,6
S. Infantis	3	2,9	20	11,7	0	0	6	4,1	37	5,1
S. Paratyphi B dT+	1	1,0	27	15,8	1	1,3	0	0	36	5,0
S. Subspec. I rough	4	3,9	0	0	0	0	15	10,1	28	3,9
S. Saintpaul	4	3,9	0	0	18	23,1	0	0	25	3,4
S. Newport	2	2,0	2	1,2	12	15,4	1	0,7	23	3,2
S. Senftenberg	0	0	17	9,9	1	1,3	0	0	20	2,8
S. London	0	0	1	0,6	0	0	6	4,1	11	1,5
S. Hadar	1	1,0	0	0	8	10,3	0	0	9	1,2
S. Ohio	0	0	8	4,7	0	0	0	0	9	1,2
S. Indiana	0	0	7	4,1	0	0	0	0	9	1,2
S. Brandenburg	3	2,9	0	0	1	1,3	3	2,0	9	1,2
S. Anatum	1	1,0	3	1,8	1	1,3	1	0,7	8	1,1
S. Livingstone	2	2,0	1	0,6	0	0	2	1,4	8	1,1
S. Dublin	2	2,0	0	0	0	0	2	1,4	8	1,1
S. 4,12:d:-	0	0	3	1,8	2	2,6	3	2,0	8	1,1
S. Bovismorbificans	2	2,0	0	0	0	0	0	0	7	1,0
S. Virchow	0	0	2	1,2	2	2,6	0	0	5	0,7
S. Kottbus	0	0	0	0	4	5,1	0	0	4	0,6
S. Bredeney	0	0	0	0	3	3,8	0	0	3	0,4
Other serovars	8	7,8	5	2,9	3	3,8	4	2,7	33	4,5

Tab. 20.117: Development of resistance rates of the ten most frequent serovars from meat (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	910	746	1037	678	793	1542	1025	926	785	727	9169
S. Typhimurium	35,6	50,9	39,2	39,4	42,5	43,7	34,7	29,9	28,3	24,2	37,3
S. 4,[5],12:i:-	0,4	0,8	1,3	3,7	3,3	7,2	5,6	8,9	12,1	20,9	6,2
S. Enteritidis	13,1	10,7	10,3	18,3	6,4	5,8	7,7	10,0	7,6	7,0	9,3
S. Derby	2,2	3,6	4,1	2,9	3,4	7,8	6,7	5,6	4,8	6,6	5,1
S. Infantis	6,0	4,6	2,7	5,0	6,9	4,9	3,3	3,7	2,9	5,1	4,5
S. Paratyphi B dT+	20,7	4,6	3,8	4,1	1,9	1,7	4,7	7,6	7,9	5,0	6,0
S. Subspec. I rough	2,4	3,6	4,2	3,1	3,8	3,4	2,1	0,9	4,1	3,9	3,1
S. Saintpaul	0,7	0,7	6,0	1,3	1,6	1,2	3,1	4,4	5,4	3,4	2,8
S. Newport	0,1	0,0	0,5	0,0	0,0	0,5	1,2	1,1	1,4	3,2	0,8
S. Senftenberg	0,3	0,0	0,3	0,1	0,9	0,5	0,1	0,1	0,5	2,8	0,5
Other serovars	18,5	20,5	27,7	22,0	29,3	23,3	30,7	27,9	25,0	18,0	24,5

Tab. 20.118: Development of resistance rates of the ten most frequent serovars from pork (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	118	144	148	110	109	581	185	156	140	148	1839
S. Typhimurium	62,7	65,3	63,5	50,9	59,6	49,9	55,1	45,5	42,9	35,8	52,1
S. 4,[5],12:i:-	0,0	2,8	3,4	3,6	5,5	8,4	10,8	22,4	20,7	25,7	10,3
S. Subspec. I rough	2,5	4,9	10,8	3,6	2,8	3,8	2,2	1,3	8,6	10,1	4,8
S. Derby	5,1	5,6	10,8	8,2	7,3	11,0	12,4	9,6	12,1	8,8	9,7
S. Infantis	9,3	3,5	2,0	18,2	3,7	3,4	1,1	3,8	0,0	4,1	4,2
S. London	0,8	2,1	1,4	0,9	0,9	1,9	1,6	3,2	1,4	4,1	1,9
S. Brandenburg	2,5	2,8	0,0	0,0	1,8	1,4	3,2	0,6	2,9	2,0	1,7
S. 4,12:d:-	0,0	0,0	0,0	0,0	0,0	0,5	0,0	0,0	0,0	2,0	0,3
S. Livingstone	0,8	1,4	1,4	0,9	0,9	0,3	0,0	0,6	4,3	1,4	1,0
S. Dublin	0,0	0,0	0,0	0,0	0,0	0,0	1,6	0,0	0,0	1,4	0,3
S. Enteritidis	6,8	2,8	1,4	0,0	1,8	1,2	0,5	3,8	0,0	0,7	1,7
Other serovars	9,3	9,0	5,4	13,6	15,6	18,1	11,4	9,0	7,1	4,1	12,0

Tab. 20.119: Development of resistance rates of the ten most frequent serovars from chicken meat (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	358	145	178	170	219	158	239	246	202	171	2086
S. Enteritidis	21,8	36,6	49,4	58,2	14,6	31,0	21,3	26,8	22,3	19,3	28,5
S. Paratyphi B dT+	50,6	21,4	15,7	14,7	6,8	12,0	17,2	21,1	29,7	15,8	23,0
S. Typhimurium	9,2	11,7	5,1	7,1	21,5	8,2	5,9	6,9	7,4	13,5	9,6
S. Infantis	2,5	2,1	7,9	1,8	13,2	8,9	9,6	6,1	7,4	11,7	7,0
S. 4,[5],12:i:-	0,0	0,0	0,0	0,0	0,0	0,6	0,0	0,8	1,5	11,1	1,2
S. Senftenberg	0,6	0,0	0,6	0,6	0,5	1,3	0,0	0,0	0,0	9,9	1,2
S. Ohio	0,3	0,0	0,0	0,0	0,5	3,2	4,2	5,7	2,0	4,7	2,1
S. Indiana	2,0	0,0	3,4	0,6	1,4	8,9	3,3	4,5	5,4	4,1	3,3
S. 4,12:d:-	0,0	0,7	0,6	2,4	9,6	4,4	8,8	1,6	2,5	1,8	3,2
S. Anatum	0,0	0,0	0,0	1,8	8,2	0,6	2,9	1,2	2,0	1,8	1,9
Other serovars	13,1	27,6	17,4	12,9	23,7	20,9	26,8	25,2	19,8	6,4	19,3

Tab. 20.120: Development of resistance rates of the ten most frequent serovars from turkey meat (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	48	179	318	172	108	117	141	80	72	87	1322
S. Saintpaul	0,0	2,2	36,2	30,8	10,2	24,8	12,8	31,3	41,7	35,6	25,6
S. Typhimurium	2,1	16,8	4,7	9,3	31,5	10,3	9,2	8,8	6,9	21,8	12,3
S. Heidelberg	20,8	24,6	21,7	21,5	6,5	2,6	10,6	1,3	0,0	5,7	15,5
S. 4,[5],12:i:-	0,0	0,0	0,0	0,0	0,0	0,9	0,7	1,3	2,8	4,6	0,7
S. Subspec. I rough	2,1	1,7	2,5	1,2	5,6	6,8	0,7	0,0	4,2	3,4	2,8
S. Newport	4,2	0,6	0,0	0,0	0,0	0,0	0,0	0,0	2,8	3,4	0,6
S. Montevideo	0,0	0,6	0,3	2,3	4,6	11,1	0,7	1,3	0,0	2,3	2,3
S. Infantis	2,1	2,8	0,3	0,0	0,0	0,9	0,0	0,0	1,4	2,3	0,9
S. Minnesota	0,0	0,0	0,3	0,0	0,0	0,0	0,0	0,0	1,4	2,3	0,3
S. Schwarzengrund	0,0	0,0	0,0	0,0	0,0	0,0	1,4	0,0	0,0	2,3	0,3
S. Give	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,3	0,2
S. Enteritidis	29,2	5,0	2,8	1,2	7,4	6,8	2,8	10,0	2,8	1,1	5,3
Other serovars	39,6	45,8	31,1	33,7	34,3	35,9	61,0	46,3	36,1	12,6	40,2

Tab. 20.121: Development of resistance rates of the ten most frequent serovars from minced meat (2000–2009)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Number of isolates	149	198	214	202	188	237	151	128	156	102	1725
S. 4,[5],12:i:-	0,6	0,5	2,3	6,4	8,5	11,0	7,3	14,8	19,9	28,4	8,9
S. Typhimurium	31,6	72,2	67,8	58,9	56,9	52,7	57,6	52,3	42,3	24,5	57,8
S. Derby	1,4	7,6	8,4	3,5	2,1	4,6	9,3	13,3	8,3	13,7	6,8
S. Subspec. I rough	1,1	3,0	6,5	5,0	6,4	3,0	6,0	0,0	6,4	3,9	4,4
S. Saintpaul	0,0	0,0	0,0	0,0	0,0	0,4	0,0	0,8	2,6	3,9	0,6
S. Infantis	0,8	2,0	3,3	1,5	3,2	10,5	0,7	2,3	1,3	2,9	3,3
S. Brandenburg	0,6	2,5	1,9	3,5	2,7	0,4	2,6	0,0	3,2	2,9	2,1
S. Bovismorbificans	0,0	0,5	0,0	0,0	1,6	5,1	0,0	1,6	4,5	2,0	1,6
S. Dublin	0,0	0,0	0,0	0,5	1,1	0,4	2,6	1,6	0,0	2,0	0,7
S. Livingstone	0,3	0,0	0,5	0,0	0,5	0,4	1,3	0,8	0,6	2,0	0,6
S. Newport	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,0	0,1
S. Enteritidis	5,4	2,5	1,4	5,4	3,2	0,0	2,6	3,1	2,6	1,0	2,7
Other serovars	7,4	9,1	7,9	15,3	13,8	11,4	9,9	9,4	8,3	10,8	10,5

20.3.2 Development of resistance rates in Salmonella isolates from food

20.3.2.1 Isolates from meat

Tab. 20.122: Resistance rates in *Salmonella* isolates from meat 2009

	Salmonella spp.	*S.* Enteritidis	*S.* Typhimurium	*S.* 4,[5],12:i:-	*S.* Infantis	*S.* Paratyphi BdT+
Tested isolates	727	51	176	152	37	36
Susceptible	33,3	74,5	21,0	5,3	40,5	2,8
Resistant	66,7	25,5	79,0	94,7	59,5	97,2
Multiresistant (2)	57,5	0	74,4	90,1	48,6	88,9
Gentamicin	2,2	0	0,6	0	0	8,3
Kanamycin	5,5	0	5,7	4,6	0	11,1
Streptomycin	43,1	0	60,8	89,5	21,6	25,0
Chloramphenicol	11,3	0	35,8	0,7	2,7	16,7
Florfenicol	8,1	0	31,3	0	0	0
Cefotaxime (1)	1,2	0	0	0	5,4	13,9
Ceftazidime (1)	1,2	0	0	0	5,4	13,9
Nalidixic acid	13,2	17,6	6,8	0	35,1	77,8
Ciprofloxacin	14,9	19,6	6,8	0	35,1	80,6
Ampicillin	50,6	5,9	74,4	89,5	10,8	36,1
Sulfamethoxazol	50,8	0	73,3	90,1	45,9	44,4
Trimethoprim (1)	17,6	0	23,3	3,9	5,4	97,2
Tetracycline	50,9	0	71,0	85,5	37,8	25,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.123: Development of resistance rates in *Salmonella* spp. from meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	910	746	1037	678	793	1542	1025	926	785	727
Susceptible	19	29,8	38,7	49,1	42,1	41,9	45,4	37,8	36,6	33,3
Resistant	81	70,2	61,3	50,9	57,9	58,1	54,6	62,2	63,4	66,7
Multiresistant (2)	54,4	48,1	52,7	38,8	43,3	44	45,6	54,1	55,8	57,5
Gentamicin	1,8	1,2	9,6	1,5	2,9	1,2	1,4	2,6	3,6	2,2
Kanamycin	4,9	2,7	10	3,1	5	4,7	5,9	9,8	6,6	5,5
Streptomycin	30,7	35,7	34,6	30,8	30,8	36,4	34,4	35,6	35,4	43,1
Chloramphenicol	16	20,1	18,4	16,5	14,2	14,1	13,1	10,2	11,2	11,3
Florfenicol	10,1	17,6	13,3	14,6	11,5	12,8	10,7	8,2	9,6	8,1
Cefotaxime (1)	-	-	-	-	-	-	-	1,9	1,1	1,2
Ceftazidime (1)	-	-	-	-	-	-	-	1,9	1,1	1,2
Nalidixic acid	16,2	9,4	13,7	10,6	9,1	8,3	10,8	19,4	18,5	13,2
Ciprofloxacin	17,1	9,7	13,3	10,9	9,6	8,8	11,6	20,1	19,7	14,9
Ampicillin	30,4	33,6	38,8	33,2	37,5	37,4	32,5	41,7	43,8	50,6
Sulfamethoxazol	75,1	61,8	52	38,2	48	44,9	38	42,2	48,8	50,8
Trimethoprim (1)	-	-	-	-	-	-	-	11,3	17,6	17,6
Tetracycline	28,8	41,2	43,4	34,2	37,2	45,3	44,2	46,1	45,9	50,9

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.124: Development of resistance rates in *S.* Enteritidis from meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	119	80	107	124	51	90	79	93	60	51
Susceptible	47,9	77,5	89,7	81,5	90,2	78,9	88,6	90,3	93,3	74,5
Resistant	52,1	22,5	10,3	18,5	9,8	21,1	11,4	9,7	6,7	25,5
Multiresistant (2)	6,7	2,5	2,8	3,2	5,9	6,7	1,3	1,1	0	0
Gentamicin	0,8	0	3,7	0,8	2	1,1	0	0	0	0
Kanamycin	0	0	0	0	3,9	0	0	0	0	0
Streptomycin	1,7	1,3	5,6	0,8	3,9	3,3	0	1,1	0	0
Chloramphenicol	0	0	0,9	0	3,9	0	0	0	0	0
Florfenicol	0	0	0,9	0	2	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	4,2	5	4,7	13,7	5,9	18,9	8,9	4,3	5	17,6
Ciprofloxacin	5	6,3	4,7	14,5	5,9	18,9	10,1	4,3	5	19,6
Ampicillin	0	6,3	0,9	2,4	2	1,1	2,5	5,4	1,7	5,9
Sulfamethoxazol	49,6	12,5	1,9	3,2	5,9	4,4	0	0	0	0
Trimethoprim (1)	-	-	-	-	-	-	-	0	0	0
Tetracycline	1,7	2,5	0,9	0	2	6,7	0	0	0	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.125: Development of resistance rates in *S.* Typhimurium from meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	324	380	406	267	337	674	356	277	222	176
Susceptible	14,8	17,9	26,6	29,6	27,9	23,1	30,1	29,2	21,2	21,0
Resistant	85,2	82,1	73,4	70,4	72,1	76,9	69,9	70,8	78,8	79,0
Multiresistant (2)	62,3	63,2	65,5	61,4	61,4	62,8	60,7	63,5	68,5	74,4
Gentamicin	1,9	0,3	2,7	0,4	2,7	1	0,8	0,4	0,9	0,6
Kanamycin	7,4	2,9	4,7	3	6,2	7,7	6,2	10,8	4,1	5,7
Streptomycin	47,5	53,4	59,9	55,8	52,2	58,5	52,5	52	50,9	60,8
Chloramphenicol	37,3	35,3	35,7	35,6	26,1	27,6	30,6	24,5	30,6	35,8
Florfenicol	25,9	33,2	30	34,5	24,9	26,7	29,5	22,7	27,9	31,3
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	4,9	4,5	2,5	3,4	6,5	4,6	4,5	4,3	8,6	6,8
Ciprofloxacin	6,5	4,5	2,5	3,4	6,2	4,9	5,1	4,7	9,5	6,8
Ampicillin	45,7	50,3	60,1	56,2	58,5	57,3	55,3	59,9	65,8	74,4
Sulfamethoxazol	80,9	76,8	66,3	61,8	67,1	63,1	60,7	61,4	70,3	73,3
Trimethoprim (1)	-	-	-	-	-	-	-	11,1	16,7	23,3
Tetracycline	56,8	57,4	67,5	62,5	54	67,5	64,3	64,3	63,1	71,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.126: Development of resistance rates in *S.* 4,[5],12:i:- from meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	4	6	13	25	26	111	57	82	95	152
Susceptible	25	0	38,5	28	7,7	7,2	1,8	1,2	4,2	5,3
Resistant	75	100	61,5	72	92,3	92,8	98,2	98,8	95,8	94,7
Multiresistant (2)	50	83,3	46,2	24	57,7	82	84,2	89	93,7	90,1
Gentamicin	0	33,3	30,8	0	3,8	0	0	1,2	0	0
Kanamycin	0	0	0	0	0	0,9	5,3	1,2	1,1	4,6
Streptomycin	0	66,7	38,5	24	46,2	78,4	82,5	85,4	91,6	89,5
Chloramphenicol	0	33,3	38,5	8	7,7	5,4	12,3	9,8	2,1	0,7
Florfenicol	0	0	7,7	8	3,8	2,7	3,5	7,3	1,1	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	0	0	0	8	0	2,7	0	3,7	0	0
Ciprofloxacin	0	0	0	8	0	2,7	1,8	4,9	1,1	0
Ampicillin	0	66,7	46,2	20	50	73,9	82,5	87,8	91,6	89,5
Sulfamethoxazol	50	83,3	46,2	56	65,4	80,2	84,2	86,6	93,7	90,1
Trimethoprim (1)	-	-	-	-	-	-	-	0	4,2	3,9
Tetracycline	75	100	61,5	40	76,9	85,6	93	95,1	90,5	85,5

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.127: Development of resistance rates in *S.* Paratyphi B dT+ from meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	188	34	39	28	15	26	48	70	62	36
Susceptible	0	0	0	0	0	0	0	0	0	2,8
Resistant	100	100	100	100	100	100	100	100	100	97,2
Multiresistant (2)	98,9	94,1	89,7	75	86,7	69,2	87,5	94,3	95,2	88,9
Gentamicin	0	8,8	0	3,6	0	3,8	2,1	0	4,8	8,3
Kanamycin	0,5	0	5,1	3,6	6,7	0	2,1	5,7	8,1	11,1
Streptomycin	35,1	32,4	15,4	35,7	26,7	11,5	16,7	28,6	25,8	25,0
Chloramphenicol	2,7	0	7,7	0	0	3,8	2,1	0	3,2	16,7
Florfenicol	0,5	0	0	0	0	3,8	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	50	12,9	13,9
Ceftazidime (1)	-	-	-	-	-	-	-	50	12,9	13,9
Nalidixic acid	46,8	64,7	43,6	46,4	53,3	38,5	64,6	74,3	74,2	77,8
Ciprofloxacin	47,9	67,6	43,6	50	53,3	50	68,8	74,3	75,8	80,6
Ampicillin	52,7	67,6	46,2	46,4	60	57,7	39,6	34,3	41,9	36,1
Sulfamethoxazol	85,6	88,2	79,5	60,7	73,3	50	41,7	44,3	53,2	44,4
Trimethoprim (1)	-	-	-	-	-	-	-	100	100	97,2
Tetracycline	3,2	20,6	15,4	17,9	26,7	34,6	35,4	24,3	30,6	25,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.128: Development of resistance rates in *S.* Infantis from meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	55	34	28	34	55	75	34	34	23	37
Susceptible	36,4	76,5	50	88,2	58,2	81,3	50	52,9	21,7	40,5
Resistant	63,6	23,5	50	11,8	41,8	18,7	50	47,1	78,3	59,5
Multiresistant (2)	12,7	8,8	46,4	11,8	23,6	16	41,2	38,2	60,9	48,6
Gentamicin	0	2,9	0	0	0	0	0	2,9	4,3	0
Kanamycin	0	0	0	0	0	1,3	2,9	0	0	0
Streptomycin	10,9	11,8	7,1	2,9	3,6	5,3	17,6	11,8	13	21,6
Chloramphenicol	0	0	0	5,9	1,8	1,3	0	2,9	0	2,7
Florfenicol	0	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	5,4
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	5,4
Nalidixic acid	1,8	2,9	42,9	5,9	9,1	10,7	41,2	29,4	60,9	35,1
Ciprofloxacin	1,8	2,9	42,9	5,9	7,3	10,7	41,2	29,4	60,9	35,1
Ampicillin	0	0	7,1	2,9	9,1	8	8,8	17,6	8,7	10,8
Sulfamethoxazol	63,6	14,7	46,4	8,8	25,5	16	41,2	38,2	60,9	45,9
Trimethoprim (1)	-	-	-	-	-	-	-	100	13	5,4
Tetracycline	7,3	5,9	39,3	5,9	27,3	12	35,3	32,4	47,8	37,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.3.2.2 Isolates from pork

Tab. 20.129: Resistance rate in *Salmonella* spp. isolates from pork

	Salmonella spp.	*S.* Enteritidis	*S.* Typhimurium	*S.* 4,[5],12:i:-	*S.* Derby	*S.* Infantis
Tested isolates	148	1	53	38	13	6
Susceptible	31,1	100	18,9	5,3	84,6	66,7
Resistant	68,9	0	81,1	94,7	15,4	33,3
Multiresistant (2)	62,2	0	77,4	92,1	7,7	0
Gentamicin	0,7	0	1,9	0	0	0
Kanamycin	3,4	0	5,7	2,6	0	0
Streptomycin	55,4	0	60,4	89,5	7,7	16,7
Chloramphenicol	13,5	0	32,1	0	0	0
Florfenicol	10,8	0	28,3	0	0	0
Cefotaxime (1)	0	0	0	0	0	0
Ceftazidime (1)	0	0	0	0	0	0
Nalidixic acid	2,7	0	5,7	0	0	16,7
Ciprofloxacin	2,7	0	5,7	0	0	16,7
Ampicillin	58,8	0	75,5	89,5	0	0
Sulfamethoxazol	61,5	0	77,4	92,1	15,4	0
Trimethoprim (1)	16,2	0	26,4	7,9	15,4	0
Tetracycline	60,8	0	73,6	89,5	0	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.130: Development of resistance rates in *Salmonella* spp. from pork

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	118	144	148	110	109	581	185	156	140	148
Susceptible	19,5	24,3	29,7	42,7	33	39,1	39,5	25,6	23,6	31,1
Resistant	80,5	75,7	70,3	57,3	67	60,9	60,5	74,4	76,4	68,9
Multiresistant (2)	48,3	57,6	62,8	50,9	49,5	41,7	53	65,4	65,7	62,2
Gentamicin	1,7	1,4	2,7	0	1,8	0,2	1,6	0,6	2,1	0,7
Kanamycin	5,9	1,4	8,8	2,7	3,7	4,3	1,6	12,2	6,4	3,4
Streptomycin	38,1	47,2	52	40,9	43,1	35,8	44,3	55,1	52,9	55,4
Chloramphenicol	26,3	31,9	31,1	24,5	25,7	15,1	19,5	16,7	13,6	13,5
Florfenicol	13,6	26,4	20,3	23,6	24,8	13,4	18,4	15,4	10,7	10,8
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	2,5	2,1	1,4	3,6	4,6	4,8	1,6	1,9	3,6	2,7
Ciprofloxacin	3,4	2,1	0	3,6	4,6	5,3	2,7	2,6	3,6	2,7
Ampicillin	37,3	43,8	53,4	40,9	49,5	33,6	45,4	62,8	60	58,8
Sulfamethoxazol	78	71,5	62,8	50,9	56,9	45,1	53	62,8	67,1	61,5
Trimethoprim (1)	-	-	-	-	-	-	-	14,3	13,6	16,2
Tetracycline	44,1	52,8	66,2	48,2	54,1	48,7	54,6	66,7	62,1	60,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.131: Development of resistance rates in *S.* Typhimurium from pork

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	74	94	94	56	65	290	102	71	60	53
Susceptible	17,6	21,3	22,3	23,2	21,5	21,7	23,5	9,9	3,3	18,9
Resistant	82,4	78,7	77,7	76,8	78,5	78,3	76,5	90,1	96,7	81,1
Multiresistant (2)	64,9	69,1	74,5	71,4	72,3	56,6	63,7	84,5	83,3	77,4
Gentamicin	1,4	0	0	0	3,1	0,3	2	0	1,7	1,9
Kanamycin	5,4	2,1	11,7	3,6	6,2	7,9	1	26,8	10	5,7
Streptomycin	52,7	58,5	66	60,7	63,1	52,1	54,9	70,4	63,3	60,4
Chloramphenicol	37,8	42,6	39,4	42,9	40	24,5	32,4	26,8	23,3	32,1
Florfenicol	20,3	38,3	27,7	41,1	40	23,4	32,4	25,4	18,3	28,3
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	2,7	3,2	0	5,4	4,6	4,8	1	0	3,3	5,7
Ciprofloxacin	4,1	3,2	0	5,4	4,6	5,2	2	0	3,3	5,7
Ampicillin	54,1	55,3	67	58,9	70,8	47,6	59,8	83,1	76,7	75,5
Sulfamethoxazol	78,4	75,5	75,5	69,6	75,4	56,6	65,7	80,3	83,3	77,4
Trimethoprim (1)	-	-	-	-	-	-	-	16,7	20	26,4
Tetracycline	59,5	61,7	75,5	69,6	70,8	66,6	68,6	81,7	75	73,6

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.132: Development of resistance rates in *S.* Enteritidis from pork

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	8	4	2	0	2	7	1	6	0	1
Susceptible	25	100	100	-	100	100	100	100	-	100
Resistant	75	0	0	-	0	0	0	0	-	0
Multiresistant (2)	0	0	0	-	0	0	0	0	-	0
Gentamicin	0	0	0	-	0	0	0	0	-	0
Kanamycin	0	0	0	-	0	0	0	0	-	0
Streptomycin	0	0	0	-	0	0	0	0	-	0
Chloramphenicol	0	0	0	-	0	0	0	0	-	0
Florfenicol	0	0	0	-	0	0	0	0	-	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	-	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	-	0
Nalidixic acid	0	0	0	-	0	0	0	0	-	0
Ciprofloxacin	0	0	0	-	0	0	0	0	-	0
Ampicillin	0	0	0	-	0	0	0	0	-	0
Sulfamethoxazol	75	0	0	-	0	0	0	0	-	0
Trimethoprim (1)	-	-	-	-	-	-	-	-	-	0
Tetracycline	0	0	0	-	0	0	0	0	-	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.133: Development of resistance rates in *S.* Derby from pork

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	6	8	16	9	8	64	23	15	17	13
Susceptible	33,3	50	25	22,2	62,5	65,6	91,3	46,7	47,1	84,6
Resistant	66,7	50	75	77,8	37,5	34,4	8,7	53,3	52,9	15,4
Multiresistant (2)	33,3	12,5	50	55,6	0	14,1	8,7	20	29,4	7,7
Gentamicin	0	0	0	0	0	0	0	6,7	0	0
Kanamycin	0	0	6,3	11,1	0	0	0	0	0	0
Streptomycin	16,7	12,5	18,8	11,1	0	4,7	4,3	13,3	17,6	7,7
Chloramphenicol	0	0	0	11,1	0	0	0	0	5,9	0
Florfenicol	0	0	0	11,1	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	0	0	0	0	0	0	0	0	5,9	0
Ciprofloxacin	0	0	0	0	0	0	0	0	5,9	0
Ampicillin	0	0	12,5	33,3	0	0	4,3	26,7	11,8	0
Sulfamethoxazol	66,7	37,5	43,8	66,7	0	14,1	8,7	13,3	29,4	15,4
Trimethoprim (1)	-	-	-	-	-	-	-	0	17,6	15,4
Tetracycline	33,3	25	68,8	33,3	37,5	34,4	4,3	33,3	35,3	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.134: Development of resistance rates in *S.* Infantis from pork

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	11	5	3	20	4	20	2	6	0	6
Susceptible	36,4	40	100	95	100	95	100	83,3	-	66,7
Resistant	63,6	60	0	5	0	5	0	16,7	-	33,3
Multiresistant (2)	0	20	0	5	0	0	0	16,7	-	0
Gentamicin	0	0	0	0	0	0	0	0	-	0
Kanamycin	0	0	0	0	0	0	0	0	-	0
Streptomycin	0	20	0	5	0	0	0	0	-	16,7
Chloramphenicol	0	0	0	0	0	0	0	0	-	0
Florfenicol	0	0	0	0	0	0	0	0	-	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	-	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	-	0
Nalidixic acid	0	0	0	0	0	5	0	16,7	-	16,7
Ciprofloxacin	0	0	0	0	0	5	0	16,7	-	16,7
Ampicillin	0	0	0	0	0	0	0	0	-	0
Sulfamethoxazol	63,6	60	0	5	0	0	0	16,7	-	0
Trimethoprim (1)	-	-	-	-	-	-	-	-	-	0
Tetracycline	0	0	0	0	0	0	0	16,7	-	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.135: Development of resistance rates in *S.* 4,[5],12:i:- from pork

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	0	4	5	4	6	49	20	35	29	38
Susceptible	-	0	0	0	0	10,2	0	0	6,9	5,3
Resistant	-	100	100	100	100	89,8	100	100	93,1	94,7
Multiresistant (2)	-	100	100	50	33,3	73,5	95	91,4	89,7	92,1
Gentamicin	-	50	80	0	0	0	0	0	0	0
Kanamycin	-	0	0	0	0	0	5	0	3,4	2,6
Streptomycin	-	100	80	50	16,7	69,4	90	85,7	86,2	89,5
Chloramphenicol	-	50	100	0	0	4,1	5	17,1	0	0
Florfenicol	-	0	20	0	0	2	0	14,3	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	-	0	0	0	0	4,1	0	5,7	0	0
Ciprofloxacin	-	0	0	0	0	4,1	5	8,6	0	0
Ampicillin	-	100	100	50	16,7	63,3	85	88,6	86,2	89,5
Sulfamethoxazol	-	100	100	50	50	69,4	95	85,7	89,7	92,1
Trimethoprim (1)	-	-	-	-	-	-	-	0	3,4	7,9
Tetracycline	-	100	100	100	83,3	83,7	100	97,1	89,7	89,5

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.3.2.3 Isolates from chicken meat

Tab. 20.136: Resistance rates in *Salmonella* spp. isolates from chicken meat

	Salmonella spp.	*S.* Typhimurium	*S.* Enteritidis	*S.* Paratyphi BdT+	*S.* 4,12:d:-	*S.* Infantis
Tested isolates	171	23	33	27	3	20
Susceptible	46,2	47,8	78,8	0	100	20,0
Resistant	53,8	52,2	21,2	100	0	80,0
Multiresistant (2)	45,0	43,5	0	92,6	0	75,0
Gentamicin	1,8	0	0	11,1	0	0
Kanamycin	3,5	4,3	0	14,8	0	0
Streptomycin	24,0	43,5	0	29,6	0	20,0
Chloramphenicol	8,8	34,8	0	18,5	0	5,0
Florfenicol	4,7	34,8	0	0	0	0
Cefotaxime (1)	3,5	0	0	14,8	0	10,0
Ceftazidime (1)	3,5	0	0	14,8	0	10,0
Nalidixic acid	28,7	21,7	21,2	81,5	0	55,0
Ciprofloxacin	29,8	21,7	21,2	85,2	0	55,0
Ampicillin	28,7	39,1	0	37,0	0	20,0
Sulfamethoxazol	35,7	43,5	0	44,4	0	70,0
Trimethoprim (1)	21,1	4,3	0	100	0	10,0
Tetracycline	29,8	47,8	0	29,6	0	60,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.137: Development of resistance rates in *Salmonella* spp. from chicken meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	358	145	178	170	219	158	239	246	202	171
Susceptible	17,6	49	62,4	66,5	56,6	60,8	60,8	55,7	48,5	46,2
Resistant	82,4	51	37,6	33,5	43,4	39,2	39,3	44,3	51,5	53,8
Multiresistant (2)	60,3	31,7	29,2	17,1	30,1	27,8	29,3	37,8	43,1	45,0
Gentamicin	0,3	2,1	3,9	1,2	0,5	0,6	0,4	0,8	2,5	1,8
Kanamycin	1,1	1,4	1,7	0,6	2,7	1,3	5	9,8	4,5	3,5
Streptomycin	21,8	14,5	8,4	8,2	11,4	9,5	6,7	13	12,9	24,0
Chloramphenicol	3,1	3,4	2,2	1,2	1,4	1,9	1,3	3,7	1,5	8,8
Florfenicol	1,1	2,8	0,6	0,6	0	1,9	0	1,2	0,5	4,7
Cefotaxime (1)	-	-	-	-	-	-	-	12,5	4	3,5
Ceftazidime (1)	-	-	-	-	-	-	-	12,5	4	3,5
Nalidixic acid	30,2	23,4	21,3	20,6	16	17,1	21,8	30,5	32,7	28,7
Ciprofloxacin	31	24,1	21,3	21,8	16	17,1	23	30,5	33,2	29,8
Ampicillin	29,1	21,4	16,3	9,4	21,9	18,4	13	23,2	21,3	28,7
Sulfamethoxazol	72,3	39,3	25,3	12,9	31,5	22,2	18,4	22,4	26,7	35,7
Trimethoprim (1)	-	-	-	-	-	-	-	25	34,2	21,1
Tetracycline	7	14,5	12,9	5,9	22,8	19	19,2	20,3	23,8	29,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.138: Development of resistance rates in *S.* Typhimurium from chicken meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	33	17	9	12	47	13	14	17	15	23
Susceptible	36,4	41,2	66,7	83,3	70,2	69,2	85,7	70,6	80	47,8
Resistant	63,6	58,8	33,3	16,7	29,8	30,8	14,3	29,4	20	52,2
Multiresistant (2)	9,1	35,3	33,3	8,3	25,5	30,8	14,3	29,4	20	43,5
Gentamicin	0	0	0	0	0	0	0	0	0	0
Kanamycin	0	0	11,1	0	4,3	0	7,1	5,9	0	4,3
Streptomycin	9,1	29,4	22,2	8,3	23,4	23,1	7,1	17,6	13,3	43,5
Chloramphenicol	6,1	23,5	11,1	8,3	2,1	15,4	0	17,6	6,7	34,8
Florfenicol	3	23,5	11,1	8,3	0	15,4	0	17,6	6,7	34,8
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	0	5,9	22,2	8,3	17	15,4	0	17,6	0	21,7
Ciprofloxacin	0	5,9	22,2	8,3	17	15,4	0	17,6	0	21,7
Ampicillin	6,1	29,4	22,2	8,3	23,4	30,8	14,3	23,5	13,3	39,1
Sulfamethoxazol	60,6	52,9	33,3	8,3	27,7	30,8	14,3	23,5	20	43,5
Trimethoprim (1)	-	-	-	-	-	-	-	0	6,7	4,3
Tetracycline	6,1	23,5	22,2	16,7	25,5	23,1	7,1	29,4	13,3	47,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.139: Development of resistance rates in *S.* Enteritidis from chicken meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	78	53	88	99	32	49	51	66	45	33
Susceptible	47,4	77,4	90,9	80,8	90,6	85,7	88,2	90,9	95,6	78,8
Resistant	52,6	22,6	9,1	19,2	9,4	14,3	11,8	9,1	4,4	21,2
Multiresistant (2)	7,7	0	2,3	4	3,1	0	2	0	0	0
Gentamicin	0	0	4,5	1	0	0	0	0	0	0
Kanamycin	0	0	0	0	0	0	0	0	0	0
Streptomycin	2,6	0	5,7	1	0	0	0	0	0	0
Chloramphenicol	0	0	0	0	0	0	0	0	0	0
Florfenicol	0	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	5,1	3,8	3,4	13,1	9,4	12,2	9,8	3	2,2	21,2
Ciprofloxacin	6,4	5,7	3,4	14,1	9,4	12,2	11,8	3	2,2	21,2
Ampicillin	0	3,8	0	3	0	0	2	6,1	2,2	0
Sulfamethoxazol	48,7	13,2	1,1	4	3,1	2	0	0	0	0
Trimethoprim (1)	-	-	-	-	-	-	-	0	0	0
Tetracycline	2,6	0	0	0	0	0	0	0	0	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.140: Development of resistance rates in *S.* Paratyphi B dT+ from chicken meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	181	31	28	25	15	19	41	52	60	27
Susceptible	0	0	0	0	0	0	0	0	0	0
Resistant	100	100	100	100	100	100	100	100	100	100
Multiresistant (2)	98,9	93,5	85,7	72	86,7	63,2	90,2	94,2	95	92,6
Gentamicin	0	9,7	0	4	0	5,3	2,4	0	5	11,1
Kanamycin	0,6	0	3,6	4	6,7	0	2,4	7,7	6,7	14,8
Streptomycin	33,7	35,5	14,3	36	26,7	5,3	17,1	34,6	25	29,6
Chloramphenicol	2,8	0	7,1	0	0	5,3	2,4	0	3,3	18,5
Florfenicol	0,6	0	0	0	0	5,3	0	0	0	0,0
Cefotaxime (1)	-	-	-	-	-	-	-	50	11,7	14,8
Ceftazidime (1)	-	-	-	-	-	-	-	50	11,7	14,8
Nalidixic acid	48,1	71	50	44	53,3	36,8	68,3	75	73,3	81,5
Ciprofloxacin	49,2	71	50	48	53,3	36,8	73,2	75	75	85,2
Ampicillin	53	64,5	53,6	40	60	52,6	39	34,6	40	37,0
Sulfamethoxazol	85,1	90,3	71,4	56	73,3	36,8	39	40,4	51,7	44,4
Trimethoprim (1)	-	-	-	-	-	-	-	100	100	100
Tetracycline	2,8	22,6	14,3	12	26,7	26,3	34,1	30,8	31,7	29,6

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.141: Development of resistance rates in *S.* Infantis from chicken meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	9	3	14	3	29	14	23	15	15	20
Susceptible	11,1	66,7	7,1	66,7	31	42,9	39,1	40	20	20,0
Resistant	88,9	33,3	92,9	33,3	69	57,1	60,9	60	80	80,0
Multiresistant (2)	11,1	33,3	85,7	33,3	37,9	57,1	47,8	40	53,3	75,0
Gentamicin	0	0	0	0	0	0	0	6,7	6,7	0
Kanamycin	0	0	0	0	0	0	4,3	0	0	0
Streptomycin	11,1	33,3	7,1	0	6,9	14,3	13	6,7	0	20,0
Chloramphenicol	0	0	0	33,3	0	0	0	0	0	5,0
Florfenicol	0	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	10,0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	10,0
Nalidixic acid	11,1	33,3	78,6	33,3	17,2	42,9	52,2	53,3	66,7	55,0
Ciprofloxacin	11,1	33,3	78,6	33,3	13,8	42,9	52,2	53,3	66,7	55,0
Ampicillin	0	0	14,3	0	17,2	14,3	8,7	6,7	6,7	20,0
Sulfamethoxazol	88,9	33,3	85,7	33,3	37,9	57,1	47,8	40	53,3	70,0
Trimethoprim (1)	-	-	-	-	-	-	-	-	6,7	10,0
Tetracycline	11,1	33,3	71,4	33,3	51,7	42,9	43,5	40	40	60,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.3.2.4 Isolates from turkey meat

Tab. 20.142: Resistance rate in *Salmonella* spp. isolates from turkey meat

	Salmonella spp.	*S.* Typhimurium	*S.* Saintpaul	*S.*Newport	*S.* Hadar	*S.* 4,[5],12:i:-
Tested isolates	78	5	18	12	8	15
Susceptible	14,1	20,0	11,1	8,3	0	0
Resistant	85,9	80,0	88,9	91,7	100	100
Multiresistant (2)	75,6	80,0	83,3	91,7	87,5	100
Gentamicin	10,3	0	38,9	0	0	0
Kanamycin	19,2	20,0	38,9	16,7	0	20,0
Streptomycin	47,4	80,0	55,6	0	62,5	100
Chloramphenicol	2,6	20,0	0	0	12,5	0
Florfenicol	2,6	20,0	0	0	12,5	0
Cefotaxime (1)	2,6	0	0	0	0	0
Ceftazidime (1)	2,6	0	0	0	0	0
Nalidixic acid	29,5	0	44,4	25,0	37,5	0
Ciprofloxacin	37,2	0	66,7	25,0	50	0
Ampicillin	61,5	80,0	77,8	75,0	12,5	100
Sulfamethoxazol	50,0	80,0	61,1	25,0	25,0	100
Trimethoprim (1)	15,4	20,0	22,2	8,3	25,0	0
Tetracycline	66,7	80,0	50	91,7	100	100

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.143: Development of resistance rates in *S.* Typhimurium from turkey meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	5	5	45	6	14	20	13	20	16	5
Susceptible	0	0	37,8	0	0	0	0	35	12,5	20,0
Resistant	100	100	62,2	100	100	100	100	65	87,5	80,0
Multiresistant (2)	100	80	62,2	66,7	100	100	92,3	45	87,5	80,0
Gentamicin	0	0	2,2	0	28,6	10	0	0	0	0
Kanamycin	0	0	2,2	16,7	28,6	20	0	5	0	20,0
Streptomycin	80	60	55,6	66,7	50	90	76,9	40	50	80,0
Chloramphenicol	60	80	6,7	50	21,4	55	69,2	15	50	20,0
Florfenicol	20	60	4,4	50	21,4	55	69,2	10	50	20,0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	20	0	2,2	33,3	35,7	30	38,5	25	50	0
Ciprofloxacin	20	0	2,2	33,3	35,7	30	38,5	25	50	0
Ampicillin	80	80	55,6	66,7	85,7	100	92,3	35	87,5	80,0
Sulfamethoxazol	100	80	62,2	66,7	78,6	100	84,6	45	87,5	80,0
Trimethoprim (1)	-	-	-	-	-	-	-	0	18,8	20,0
Tetracycline	100	80	53,3	83,3	85,7	90	92,3	60	87,5	80,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.144: Development of resistance rates in *S.* Saintpaul from turkey meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	4	2	54	7	6	16	22	31	22	18
Susceptible	25	50	0	0	0	25	31,8	3,2	0	11,1
Resistant	75	50	100	100	100	75	68,2	96,8	100	88,9
Multiresistant (2)	75	50	100	100	100	37,5	68,2	90,3	90,9	83,3
Gentamicin	50	0	96,3	100	50	37,5	31,8	45,2	59,1	38,9
Kanamycin	50	0	96,3	100	50	37,5	27,3	32,3	59,1	38,9
Streptomycin	75	50	70,4	100	50	6,3	22,7	45,2	36,4	55,6
Chloramphenicol	50	0	20,4	0	100	0	13,6	9,7	13,6	0
Florfenicol	0	0	9,3	0	16,7	0	4,5	9,7	13,6	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	50	50	100	100	100	75	27,3	58,1	77,3	44,4
Ciprofloxacin	50	50	100	100	100	75	31,8	67,7	86,4	66,7
Ampicillin	50	50	100	100	66,7	37,5	40,9	64,5	81,8	77,8
Sulfamethoxazol	75	50	100	100	100	37,5	63,6	71	77,3	61,1
Trimethoprim (1)	-	-	-	-	-	-	-	0	9,1	22,2

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.145: Development of resistance rates in *S.* Infantis from turkey meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	4	2	54	7	6	16	22	31	22	18
Susceptible	25	50	0	0	0	25	31,8	3,2	0	11,1
Resistant	75	50	100	100	100	75	68,2	96,8	100	88,9
Multiresistant (2)	75	50	100	100	100	37,5	68,2	90,3	90,9	83,3
Gentamicin	50	0	96,3	100	50	37,5	31,8	45,2	59,1	38,9
Kanamycin	50	0	96,3	100	50	37,5	27,3	32,3	59,1	38,9
Streptomycin	75	50	70,4	100	50	6,3	22,7	45,2	36,4	55,6
Chloramphenicol	50	0	20,4	0	100	0	13,6	9,7	13,6	0
Florfenicol	0	0	9,3	0	16,7	0	4,5	9,7	13,6	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	50	50	100	100	100	75	27,3	58,1	77,3	44,4
Ciprofloxacin	50	50	100	100	100	75	31,8	67,7	86,4	66,7
Ampicillin	50	50	100	100	66,7	37,5	40,9	64,5	81,8	77,8
Sulfamethoxazol	75	50	100	100	100	37,5	63,6	71	77,3	61,1
Trimethoprim (1)	-	-	-	-	-	-	-	0	9,1	22,2
Tetracycline	75	50	16,7	0	33,3	0	50	54,8	40,9	50

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.146: Development of resistance rates in *S.* Hadar from turkey meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	5	5	1	1	5	5	35	30	4	8
Susceptible	0	0	0	0	0	0	0	0	0	0
Resistant	100	100	100	100	100	100	100	100	100	100
Multiresistant (2)	100	60	100	100	100	100	88,6	93,3	100	87,5
Gentamicin	0	0	0	0	0	0	0	0	0	0
Kanamycin	20	0	0	0	0	0	2,9	0	0	0
Streptomycin	100	20	0	0	80	60	85,7	70	50	62,5
Chloramphenicol	0	0	0	0	0	0	5,7	0	0	12,5
Florfenicol	0	0	0	0	0	0	0	0	0	12,5
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	100	100	100	100	100	100	22,9	66,7	75	37,5
Ciprofloxacin	100	100	100	100	100	100	22,9	70	100	50
Ampicillin	0	40	0	0	100	60	20	26,7	50	12,5
Sulfamethoxazol	100	20	0	0	0	0	11,4	3,3	0	25
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	25
Tetracycline	100	60	100	100	100	100	100	100	100	100

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.3.2.5 Isolates from minced meat

Tab. 20.147: Resistenzraten bei *Salmonella* spp. isolates from minced meat

	Salmonella spp.	*S.* Typhimurium	*S.* Enteritidis	*S.* 4,[5],12:i:-	*S.* Derby	*S.* Subspec. I rough
Tested isolates	102	25	1	29	14	4
Susceptible	24,5	8,0	0	6,9	57,1	0
Resistant	75,5	92,0	100	93,1	42,9	100
Multiresistant (2)	60,8	88,0	0	86,2	7,1	75,0
Gentamicin	2,0	0	0	0	0	25,0
Kanamycin	3,9	8,0	0	0	0	25,0
Streptomycin	50	68,0	0	86,2	0	50
Chloramphenicol	13,7	48,0	0	0	0	25,0
Florfenicol	9,8	40	0	0	0	0
Cefotaxime (1)	0	0	0	0	0	0
Ceftazidime (1)	0	0	0	0	0	0
Nalidixic acid	4,9	0	0	0	0	0
Ciprofloxacin	6,9	0	0	0	0	0
Ampicillin	60,8	92,0	100	86,2	7,1	100
Sulfamethoxazol	58,8	88,0	0	86,2	14,3	75,0
Trimethoprim (1)	17,6	32,0	0	3,4	14,3	50
Tetracycline	61,8	84,0	0	86,2	28,6	75,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.148: Development of resistance rates in *S.* Typhimurium from minced meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	149	198	214	202	188	237	151	128	156	102
Susceptible	12,1	20,7	35	42,1	31,9	40,1	33,1	34,4	25	24,5
Resistant	87,9	79,3	65	57,9	68,1	59,9	66,9	65,6	75	75,5
Multiresistant (2)	64,4	55,1	54,2	44,1	50	49,8	54,3	58,6	66	62,7
Gentamicin	4	0	5,1	0,5	3,2	0,4	1,3	1,6	1,9	2,0
Kanamycin	9,4	4	2,8	2,5	6,4	5,1	6	4,7	5,1	3,9
Streptomycin	47,7	45,5	48,1	42,6	43,6	45,6	45	50,8	50	50,0
Chloramphenicol	36,9	31,8	34,1	21,8	19,1	16,5	17,9	15,6	20,5	13,7
Florfenicol	25,5	29,8	29,4	20,3	16,5	16	17,9	13,3	19,2	9,8
Cefotaxime (1)	-	-	-	-	-	-	-	0	0,6	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0,6	0
Nalidixic acid	1,3	3,5	1,9	4	1,6	0,4	2,6	0,8	5,1	4,9
Ciprofloxacin	2,7	3,5	1,9	4	1,6	0,8	2,6	1,6	7,1	6,9
Ampicillin	43,6	41,4	46,3	41,1	46,3	49,4	47	52,3	62,2	60,8
Sulfamethoxazol	81,2	74,7	55,6	47	60,6	53,2	53	57	66	58,8
Trimethoprim (1)	-	-	-	-	-	-	-	0	12,8	17,6
Tetracycline	59,1	51	54,7	46	47,3	47,7	60,3	60,9	58,3	61,8

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.149: Development of resistance rates in *S.* Typhimurium from minced meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	113	143	145	119	107	125	87	67	66	25
Susceptible	6,2	12,6	20	26,1	15	22,4	18,4	17,9	15,2	8,0
Resistant	93,8	87,4	80	73,9	85	77,6	81,6	82,1	84,8	92,0
Multiresistant (2)	76,1	67,1	66,9	60,5	68,2	68	67,8	73,1	71,2	88,0
Gentamicin	3,5	0	6,9	0,8	2,8	0,8	1,1	0	1,5	0
Kanamycin	12,4	4,2	3,4	4,2	6,5	8,8	10,3	3	4,5	8
Streptomycin	56,6	56,6	62,1	58	57,9	64	55,2	59,7	56,1	68,0
Chloramphenicol	46	42	45,5	34,5	30,8	30,4	31	29,9	40,9	48,0
Florfenicol	31,9	40,6	39,3	32,8	28	29,6	31	25,4	37,9	40,0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	0,9	4,2	2,8	1,7	1,9	0	3,4	0	1,5	0
Ciprofloxacin	2,7	4,2	2,8	1,7	1,9	0,8	3,4	1,5	3	0
Ampicillin	52,2	55,2	62,1	58,8	63,6	69,6	59,8	65,7	74,2	92,0
Sulfamethoxazol	85,8	82,5	68,3	62,2	79,4	68,8	67,8	70,1	75,8	88,0
Trimethoprim (1)	-	-	-	-	-	-	-	0	13,6	32,0
Tetracycline	70,8	62,9	73,1	65,5	60,7	68	79,3	77,6	63,6	84,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.150: Development of resistance rates in *S.* Enteritidis from minced meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	8	5	3	11	6	0	4	4	4	1
Susceptible	25	80	100	100	100	-	100	100	75	0
Resistant	75	20	0	0	0	-	0	0	25	100
Multiresistant (2)	12,5	0	0	0	0	-	0	0	0	0
Gentamicin	12,5	0	0	0	0	-	0	0	0	0
Kanamycin	0	0	0	0	0	-	0	0	0	0
Streptomycin	0	0	0	0	0	-	0	0	0	0
Chloramphenicol	0	0	0	0	0	-	0	0	0	0
Florfenicol	0	0	0	0	0	-	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	0	0	0	0	0	-	0	0	25	0
Ciprofloxacin	0	0	0	0	0	-	0	0	25	0
Ampicillin	0	0	0	0	0	-	0	0	0	100
Sulfamethoxazol	75	20	0	0	0	-	0	0	0	0
Trimethoprim (1)	-	-	-	-	-	-	-	-	0	0
Tetracycline	0	0	0	0	0	-	0	0	0	0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.151: Development of resistance rates in *S.* Derby from minced meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	5	15	18	7	4	11	14	17	13	14
Susceptible	60	66,7	94,4	71,4	100	100	78,6	88,2	76,9	57,1
Resistant	40	33,3	5,6	28,6	0	0	21,4	11,8	23,1	42,9
Multiresistant (2)	0	26,7	5,6	28,6	0	0	14,3	5,9	23,1	7,1
Gentamicin	0	0	0	0	0	0	0	0	0	0
Kanamycin	0	6,7	0	0	0	0	0	0	0	0
Streptomycin	0	26,7	5,6	28,6	0	0	0	11,8	7,7	0
Chloramphenicol	0	6,7	5,6	0	0	0	0	0	15,4	0
Florfenicol	0	0	5,6	0	0	0	0	0	15,4	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	0	0	0	0	0	0	0	0	0	0
Ciprofloxacin	0	0	0	0	0	0	0	0	0	0
Ampicillin	0	0	5,6	0	0	0	0	5,9	0	7,1
Sulfamethoxazol	40	26,7	5,6	28,6	0	0	14,3	5,9	23,1	14,3
Trimethoprim (1)	-	-	-	-	-	-	-	0	0	14,3
Tetracycline	0	26,7	5,6	28,6	0	0	14,3	0	7,7	28,6

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.152: Development of resistance rates in *S.* 4,[5],12:i:- from minced meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	2	1	5	13	16	26	11	19	31	29
Susceptible	50	0	80	15,4	12,5	3,8	0	5,3	3,2	6,9
Resistant	50	100	20	84,6	87,5	96,2	100	94,7	96,8	93,1
Multiresistant (2)	0	100	0	23,1	56,3	88,5	81,8	89,5	96,8	86,2
Gentamicin	0	0	0	0	0	0	0	5,3	0	0
Kanamycin	0	0	0	0	0	3,8	0	0	0	0
Streptomycin	0	0	0	23,1	50	84,6	81,8	89,5	93,5	86,2
Chloramphenicol	0	0	0	15,4	6,3	3,8	0	0	3,2	0
Florfenicol	0	0	0	15,4	6,3	3,8	0	0	3,2	0
Cefotaxime (1)	-	-	-	-	-	-	-	0	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	0	0	0
Nalidixic acid	0	0	0	15,4	0	0	0	0	0	0
Ciprofloxacin	0	0	0	15,4	0	0	0	0	0	0
Ampicillin	0	0	0	15,4	50	73,1	81,8	89,5	96,8	86,2
Sulfamethoxazol	0	100	0	76,9	62,5	84,6	81,8	89,5	93,5	86,2
Trimethoprim (1)	-	-	-	-	-	-	-	0	3,2	3,4
Tetracycline	50	100	20	30,8	68,8	84,6	90,9	94,7	93,5	86,2

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.153: Development of resistance rates in *S.* Infantis from minced meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	3	4	7	3	6	25	1	3	2	3
Susceptible	0	100	100	66,7	83,3	96	100	66,7	50	33,3
Resistant	100	0	0	33,3	16,7	4	0	33,3	50	66,7
Multiresistant (2)	0	0	0	33,3	16,7	0	0	33,3	50	66,7
Gentamicin	0	0	0	0	0	0	0	0	0	0
Kanamycin	0	0	0	0	0	0	0	0	0	0
Streptomycin	0	0	0	0	0	0	0	33,3	50	33,3
Chloramphenicol	0	0	0	33,3	16,7	0	0	0	0	0
Florfenicol	0	0	0	0	0	0	0	0	0	0
Cefotaxime (1)	-	-	-	-	-	-	-	-	0	0
Ceftazidime (1)	-	-	-	-	-	-	-	-	0	0
Nalidixic acid	0	0	0	0	0	0	0	0	0	33,3
Ciprofloxacin	0	0	0	0	0	0	0	0	0	33,3
Ampicillin	0	0	0	33,3	0	4	0	33,3	0	0
Sulfamethoxazol	100	0	0	0	16,7	0	0	33,3	50	66,7
Trimethoprim (1)	-	-	-	-	-	-	-	-	50	0
Tetracycline	0	0	0	0	0	0	0	33,3	50	33,3

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

Tab. 20.154: Development of resistance rates in *S.* subspec. I rough from minced meat

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tested isolates	4	6	14	10	12	7	9	0	10	4
Susceptible	0	16,7	7,1	30	16,7	57,1	0		10	0
Resistant	0	16,7	14,3	10	33,3	0	11,1		20	100
Multiresistant (2)	100	66,7	78,6	60	50	42,9	88,9		70	75,0
Gentamicin	0	0	0	0	0	0	0		0	25,0
Kanamycin	0	16,7	0	0	25	0	0		0	25,0
Streptomycin	100	66,7	64,3	60	50	42,9	88,9		60	50,0
Chloramphenicol	50	33,3	35,7	0	8,3	0	0		20	25,0
Florfenicol	50,5	16,7	35,7	0	0	0	0		20	0
Cefotaxime (1)	-	-	-	-	-	-	-		0	0
Ceftazidime (1)	-	-	-	-	-	-	-		0	0
Nalidixic acid	0	0	0	0	0	0	0		10	0
Ciprofloxacin	0	0	0	0	0	0	0		10	0
Ampicillin	100	50	50	60	50	42,8	77,8		50	100,0
Sulfamethoxazol	100	83,3	78,6	70	66,7	42,9	88,9		70	75,0
Trimethoprim (1)	-	-	-	-	-	-	-		0	50,0
Tetracycline	100	50	50	60	58,3	28,6	88,9		70	75,0

(1) Antimicrobials were tested since December 2007
(2) Resistance to more than one class of antimicrobials

20.3.3 Distribution of MIC values in Salmonella spp. isolates from food

20.3.3.1 Isolates from meat

Tab. 20.155: *Salmonella* spp. from meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	727	16	2,2						74,1	22,0	1,4	0,3	0,0	0,6	1,4	0,3	0,0					
Kanamycin	727	40	5,5										93,9	0,6	0,3	0,7	0,4	0,3	3,9			
Streptomycin	727	313	43,1									3,3	6,6	24,1	13,6	9,4	8,7	10,9	23,5			
Chloramphenicol	727	82	11,3									1,9	32,6	51,6	2,6	0,0	0,8	10,5				
Florfenicol	727	59	8,1									5,0	60,2	23,8	2,9	4,7	3,0	0,4				
Cefotaxime	727	9	1,2				32,2	46,8	17,9	1,9	0,0	0,0	0,0	1,2								
Ceftazidime	727	9	1,2						49,5	40,3	8,5	0,4	0,3	0,4	0,0	0,6						
Nalidixic acid	727	96	13,2										82,9	2,8	1,1	0,3	1,2	11,7				
Ciprofloxacin	727	108	14,9	0,4	8,5	64,9	11,3	0,6	5,6	5,6	2,2	0,8	0,0	0,0	0,0							
Ampicillin	727	368	50,6							2,9	29,3	15,8	1,4	0,0	0,0	0,0	50,6					
Colistin (1)	727													100,0	0,0	0,0						
Sulfamethoxazole	727	369	50,8											0,4	2,3	14,7	27,9	3,7	0,1	0,0	0,1	50,6
Trimethoprim	727	128	17,6							80,1	2,2	0,1	0,0	0,0	0,0	0,0	17,6					
Tetracycline	727	370	50,9								8,9	33,8	6,2	0,1	0,1	5,9	4,7	40,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.156: *S.* 4,[5],12:i:- from meat(2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	152	0	0						77,6	20,4	2,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	152	7	4,6										95,4	0,0	0,0	0,0	0,0	0,0	4,6			
Streptomycin	152	136	89,5									0,0	0,7	8,6	0,7	0,7	0,0	23,7	65,8			
Chloramphenicol	152	1	0,7									0,7	32,2	66,4	0,0	0,0	0,7	0,0				
Florfenicol	152	0	0,0									1,3	68,4	29,6	0,7	0,0	0,0	0,0				
Cefotaxime	152	0	0,0				44,1	43,4	11,8	0,7	0,0	0,0	0,0	0,0								
Ceftazidime	152	0	0,0						67,8	28,3	3,3	0,7	0,0	0,0	0,0	0,0						
Nalidixic acid	152	0	0,0										94,7	5,3	0,0	0,0	0,0	0,0				
Ciprofloxacin	152	0	0,0	0,0	2,6	80,9	16,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	152	136	89,5							0,0	7,9	2,6	0,0	0,0	0,0	0,0	89,5					
Colistin (1)	152													100,0	0,0	0,0						
Sulfamethoxazole	152	137	90,1											0,0	1,3	0,0	8,6	0,0	0,0	0,0	0,0	90,1
Trimethoprim	152	6	3,9							96,1	0,0	0,0	0,0	0,0	0,0	0,0	3,9					
Tetracycline	152	130	85,5								0,7	11,8	2,0	0,0	0,0	0,0	0,7	84,9				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.157: *S.* Enteritidis from meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	51	0	0						86,3	13,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	51	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	51	0	0,0									47,1	47,1	5,9	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	51	0	0,0									3,9	49,0	47,1	0,0	0,0	0,0	0,0				
Florfenicol	51	0	0,0									9,8	80,4	9,8	0,0	0,0	0,0	0,0				
Cefotaxime	51	0	0,0				47,1	35,3	17,6	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	51	0	0,0						74,5	23,5	2,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	51	9	17,6										80,4	0,0	2,0	0,0	3,9	13,7				
Ciprofloxacin	51	10	19,6	2,0	19,6	54,9	3,9	0,0	15,7	2,0	2,0	0,0	0,0	0,0	0,0							
Ampicillin	51	3	5,9							2,0	58,8	29,4	3,9	0,0	0,0	0,0	5,9					
Colistin (1)	51													100,0	0,0	0,0						
Sulfamethoxazole	51	0	0,0											0,0	2,0	33,3	62,7	2,0	0,0	0,0	0,0	0,0
Trimethoprim	51	0	0,0							98,0	2,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	51	0	0,0								39,2	56,9	3,9	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.158: *S.* Infantis from meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	37	0	0						81,1	18,9	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	37	0	0,0										97,3	2,7	0,0	0,0	0,0	0,0	0,0			
Streptomycin	37	8	21,6									0,0	0,0	43,2	13,5	21,6	16,2	2,7	2,7			
Chloramphenicol	37	1	2,7									0,0	29,7	64,9	2,7	0,0	2,7	0,0				
Florfenicol	37	0	0,0									2,7	48,6	43,2	5,4	0,0	0,0	0,0				
Cefotaxime	37	2	5,4				8,1	54,1	29,7	2,7	0,0	0,0	0,0	5,4								
Ceftazidime	37	2	5,4						13,5	64,9	16,2	0,0	0,0	0,0	0,0	5,4						
Nalidixic acid	37	13	35,1										64,9	0,0	0,0	0,0	2,7	32,4				
Ciprofloxacin	37	13	35,1	0,0	2,7	54,1	8,1	0,0	10,8	16,2	8,1	0,0	0,0	0,0	0,0							
Ampicillin	37	4	10,8							5,4	51,4	29,7	2,7	0,0	0,0	0,0	10,8					
Colistin (1)	37													100,0	0,0	0,0						
Sulfamethoxazole	37	17	45,9											0,0	0,0	16,2	29,7	8,1	0,0	0,0	0,0	45,9
Trimethoprim	37	2	5,4							94,6	0,0	0,0	0,0	0,0	0,0	0,0	5,4					
Tetracycline	37	14	37,8								10,8	45,9	5,4	0,0	0,0	0,0	13,5	24,3				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.159: *S.* Paratyphi B dT+ from meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3) 0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	36	3	8,3						83,3	8,3	0,0	0,0	0,0	0,0	5,6	2,8	0,0					
Kanamycin	36	4	11,1										88,9	0,0	0,0	0,0	0,0	2,8	8,3			
Streptomycin	36	9	25,0									0,0	0,0	2,8	19,4	52,8	5,6	11,1	8,3			
Chloramphenicol	36	6	16,7									5,6	36,1	38,9	2,8	0,0	5,6	11,1				
Florfenicol	36	0	0,0									19,4	55,6	22,2	2,8	0,0	0,0	0,0				
Cefotaxime	36	5	13,9				8,3	44,4	33,3	0,0	0,0	0,0	0,0	13,9								
Ceftazidime	36	5	13,9						11,1	66,7	8,3	0,0	5,6	2,8	0,0	5,6						
Nalidixic acid	36	28	77,8										16,7	2,8	2,8	0,0	0,0	77,8				
Ciprofloxacin	36	29	80,6	0,0	0,0	13,9	5,6	5,6	38,9	30,6	2,8	2,8	0,0	0,0	0,0							
Ampicillin	36	13	36,1							2,8	25,0	30,6	5,6	0,0	0,0	0,0	36,1					
Colistin (1)	36													100,0	0,0	0,0						
Sulfamethoxazole	36	16	44,4											2,8	8,3	33,3	8,3	2,8	0,0	0,0	2,8	41,7
Trimethoprim	36	35	97,2							2,8	0,0	0,0	0,0	0,0	0,0	0,0	97,2					
Tetracycline	36	9	25,0								22,2	47,2	5,6	0,0	0,0	0,0	0,0	25,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.160: *S.* Typhimurium from meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3) 0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	176	1	0,6						71,0	25,6	2,3	0,6	0,0	0,0	0,6	0,0	0,0					
Kanamycin	176	10	5,7										93,2	1,1	0,0	0,0	0,0	0,0	5,7			
Streptomycin	176	107	60,8									0,0	2,3	14,8	15,3	6,8	20,5	14,2	26,1			
Chloramphenicol	176	63	35,8									1,7	18,2	42,0	2,3	0,0	0,0	35,8				
Florfenicol	176	55	31,3									2,3	43,2	21,6	1,7	18,8	11,9	0,6				
Cefotaxime	176	0	0,0				39,2	43,2	14,8	2,8	0,0	0,0	0,0	0,0								
Ceftazidime	176	0	0,0						63,1	31,8	5,1	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	176	12	6,8										89,8	3,4	0,0	0,6	0,0	6,3				
Ciprofloxacin	176	12	6,8	0,0	6,8	74,4	11,9	0,0	4,0	2,3	0,6	0,0	0,0	0,0	0,0							
Ampicillin	176	131	74,4							0,0	13,6	11,4	0,6	0,0	0,0	0,0	74,4					
Colistin (1)	176													100,0	0,0	0,0						
Sulfamethoxazole	176	129	73,3											0,0	1,7	5,7	16,5	2,3	0,6	0,0	0,0	73,3
Trimethoprim	176	41	23,3							75,0	1,7	0,0	0,0	0,0	0,0	0,0	23,3					
Tetracycline	176	125	71,0								1,1	21,6	6,3	0,0	0,0	23,3	9,7	38,1				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.3.3.2 Isolates from pork

Tab. 20.161: *Salmonella* spp. from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	148	1	0,7						78,4	18,9	2,0	0,0	0,0	0,0	0,7	0,0	0,0					
Kanamycin	148	5	3,4										96,6	0,0	0,0	0,0	0,0	0,7	2,7			
Streptomycin	148	82	55,4									0,7	3,4	28,4	9,5	2,7	8,8	16,2	30,4			
Chloramphenicol	148	20	13,5									0,7	27,7	57,4	0,7	0,0	0,0	13,5				
Florfenicol	148	16	10,8									2,0	58,8	27,7	0,7	6,1	4,1	0,7				
Cefotaxime	148	0	0,0				39,9	50,0	8,8	1,4	0,0	0,0	0,0	0,0								
Ceftazidime	148	0	0,0						56,8	39,2	3,4	0,7	0,0	0,0	0,0	0,0						
Nalidixic acid	148	4	2,7										94,6	2,7	0,0	0,0	0,0	2,7				
Ciprofloxacin	148	4	2,7	0,0	8,1	78,4	10,8	0,0	2,0	0,7	0,0	0,0	0,0	0,0	0,0							
Ampicillin	148	87	58,8							1,4	31,8	8,1	0,0	0,0	0,0	0,0	58,8					
Colistin (1)	148													100,0	0,0	0,0						
Sulfamethoxazole	148	91	61,5											0,0	2,0	7,4	26,4	2,0	0,7	0,0	0,0	61,5
Trimethoprim	148	24	16,2							81,1	2,0	0,7	0,0	0,0	0,0	0,0	16,2					
Tetracycline	148	90	60,8								2,7	32,4	3,4	0,7	0,7	6,8	3,4	50,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.162: *S.* 4,[5],12:i:- from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	38	0	0						78,9	15,8	5,3	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	38	1	2,6										97,4	0,0	0,0	0,0	0,0	0,0	2,6			
Streptomycin	38	34	89,5									0,0	0,0	10,5	0,0	0,0	0,0	21,1	68,4			
Chloramphenicol	38	0	0,0									0,0	39,5	60,5	0,0	0,0	0,0	0,0				
Florfenicol	38	0	0,0									0,0	73,7	26,3	0,0	0,0	0,0	0,0				
Cefotaxime	38	0	0,0				44,7	44,7	7,9	2,6	0,0	0,0	0,0	0,0								
Ceftazidime	38	0	0,0						63,2	31,6	2,6	2,6	0,0	0,0	0,0	0,0						
Nalidixic acid	38	0	0,0										97,4	2,6	0,0	0,0	0,0	0,0				
Ciprofloxacin	38	0	0,0	0,0	5,3	76,3	18,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	38	34	89,5							0,0	7,9	2,6	0,0	0,0	0,0	0,0	89,5					
Colistin (1)	38													100,0	0,0	0,0						
Sulfamethoxazole	38	35	92,1											0,0	0,0	0,0	7,9	0,0	0,0	0,0	0,0	92,1
Trimethoprim	38	3	7,9							92,1	0,0	0,0	0,0	0,0	0,0	0,0	7,9					
Tetracycline	38	34	89,5								0,0	10,5	0,0	0,0	0,0	0,0	0,0	89,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.163: *S.* Derby from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	13	0	0						84,6	15,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	13	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	13	1	7,7									0,0	0,0	61,5	30,8	0,0	0,0	7,7	0,0			
Chloramphenicol	13	0	0,0									0,0	23,1	69,2	7,7	0,0	0,0	0,0				
Florfenicol	13	0	0,0									0,0	61,5	38,5	0,0	0,0	0,0	0,0				
Cefotaxime	13	0	0,0				7,7	84,6	7,7	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	13	0	0,0						7,7	92,3	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	13	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	13	0	0,0	0,0	15,4	69,2	15,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	13	0	0,0							7,7	84,6	7,7	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	13													100,0	0,0	0,0						
Sulfamethoxazole	13	2	15,4											0,0	0,0	23,1	61,5	0,0	0,0	0,0	0,0	15,4
Trimethoprim	13	2	15,4							76,9	7,7	0,0	0,0	0,0	0,0	0,0	15,4					
Tetracycline	13	0	0,0								15,4	76,9	7,7	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.164: *S.* Infantis from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	6	0	0						66,7	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	6	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	6	1	16,7									0,0	0,0	66,7	16,7	0,0	16,7	0,0	0,0			
Chloramphenicol	6	0	0,0									0,0	33,3	66,7	0,0	0,0	0,0	0,0				
Florfenicol	6	0	0,0									0,0	66,7	33,3	0,0	0,0	0,0	0,0				
Cefotaxime	6	0	0,0				0,0	66,7	33,3	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	6	0	0,0						16,7	66,7	16,7	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	6	1	16,7										83,3	0,0	0,0	0,0	0,0	16,7				
Ciprofloxacin	6	1	16,7	0,0	0,0	66,7	16,7	0,0	16,7	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	6	0	0,0							0,0	66,7	33,3	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	6													100,0	0,0	0,0						
Sulfamethoxazole	6	0	0,0											0,0	0,0	16,7	83,3	0,0	0,0	0,0	0,0	0,0
Trimethoprim	6	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	6	0	0,0								16,7	66,7	16,7	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.165: *S.* Enteritidis from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	1	0	0,0									100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	1	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	1	0	0,0				100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	1	0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	1	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	1													100,0	0,0	0,0						
Sulfamethoxazole	1	0	0,0											0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	1	0	0,0								100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.166: *S.* Typhimurium from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	53	1	1,9						79,2	17,0	1,9	0,0	0,0	0,0	1,9	0,0	0,0					
Kanamycin	53	3	5,7										94,3	0,0	0,0	0,0	0,0	0,0	5,7			
Streptomycin	53	32	60,4									0,0	3,8	20,8	7,5	7,5	20,8	18,9	20,8			
Chloramphenicol	53	17	32,1									0,0	13,2	54,7	0,0	0,0	0,0	32,1				
Florfenicol	53	15	28,3									1,9	39,6	30,2	0,0	17,0	11,3	0,0				
Cefotaxime	53	0	0,0				50,9	37,7	9,4	1,9	0,0	0,0	0,0	0,0								
Ceftazidime	53	0	0,0						73,6	24,5	1,9	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	53	3	5,7										88,7	5,7	0,0	0,0	0,0	5,7				
Ciprofloxacin	53	3	5,7	0,0	7,5	81,1	5,7	0,0	3,8	1,9	0,0	0,0	0,0	0,0	0,0							
Ampicillin	53	40	75,5							0,0	20,8	3,8	0,0	0,0	0,0	0,0	75,5					
Colistin (1)	53													100,0	0,0	0,0						
Sulfamethoxazole	53	41	77,4											0,0	5,7	3,8	11,3	0,0	1,9	0,0	0,0	77,4
Trimethoprim	53	14	26,4							71,7	1,9	0,0	0,0	0,0	0,0	0,0	26,4					
Tetracycline	53	39	73,6								0,0	22,6	3,8	0,0	0,0	18,9	9,4	45,3				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.3.3.3 Isolates from chicken meat

Tab. 20.167: *Salmonella* spp. from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	171	3	1,8						75,4	21,1	1,8	0,0	0,0	0,0	1,2	0,6	0,0					
Kanamycin	171	6	3,5										95,9	0,6	0,0	0,0	0,0	0,6	2,9			
Streptomycin	171	41	24,0									10,5	10,5	19,9	18,7	16,4	5,3	7,0	11,7			
Chloramphenicol	171	15	8,8									2,9	45,0	41,5	1,8	0,0	1,8	7,0				
Florfenicol	171	8	4,7									8,8	69,6	14,6	2,3	1,2	3,5	0,0				
Cefotaxime	171	6	3,5				24,6	43,9	25,7	2,3	0,0	0,0	0,0	3,5								
Ceftazidime	171	6	3,5						38,6	45,0	12,9	0,0	0,6	0,6	0,0	2,3						
Nalidixic acid	171	49	28,7										69,0	1,2	1,2	0,0	1,2	27,5				
Ciprofloxacin	171	51	29,8	0,6	8,8	53,2	7,6	1,8	12,9	11,7	2,9	0,6	0,0	0,0	0,0							
Ampicillin	171	49	28,7							2,3	39,8	25,7	3,5	0,0	0,0	0,0	28,7					
Colistin (1)	171													100,0	0,0	0,0						
Sulfamethoxazole	171	61	35,7											0,6	1,8	19,9	39,8	2,3	0,0	0,0	0,6	35,1
Trimethoprim	171	36	21,1							77,2	1,8	0,0	0,0	0,0	0,0	0,0	21,1					
Tetracycline	171	51	29,8								17,5	44,4	8,2	0,0	0,0	3,5	4,7	21,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.168: *S.* 4,[5],12:i:- from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	19	0	0						52,6	42,1	5,3	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	19	1	5,3										94,7	0,0	0,0	0,0	0,0	0,0	5,3			
Streptomycin	19	19	100,0									0,0	0,0	0,0	0,0	0,0	0,0	26,3	73,7			
Chloramphenicol	19	0	0,0									5,3	57,9	36,8	0,0	0,0	0,0	0,0				
Florfenicol	19	0	0,0									10,5	84,2	5,3	0,0	0,0	0,0	0,0				
Cefotaxime	19	0	0,0				36,8	42,1	21,1	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	19	0	0,0						47,4	47,4	5,3	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	19	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	19	0	0,0	0,0	0,0	84,2	15,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	19	19	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	19													100,0	0,0	0,0						
Sulfamethoxazole	19	19	100,0											0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0
Trimethoprim	19	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	19	14	73,7								5,3	15,8	5,3	0,0	0,0	0,0	5,3	68,4				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.169: *S.* 4,12:d:- from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	3	0	0						66,7	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	3	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	3	0	0,0									0,0	0,0	66,7	0,0	33,3	0,0	0,0	0,0			
Chloramphenicol	3	0	0,0									0,0	66,7	33,3	0,0	0,0	0,0	0,0				
Florfenicol	3	0	0,0									0,0	66,7	33,3	0,0	0,0	0,0	0,0				
Cefotaxime	3	0	0,0				0,0	66,7	33,3	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	3	0	0,0						0,0	66,7	33,3	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	3	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	3	0	0,0	0,0	0,0	66,7	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	3	0	0,0							0,0	66,7	0,0	33,3	0,0	0,0	0,0	0,0					
Colistin (1)	3													100,0	0,0	0,0						
Sulfamethoxazole	3	0	0,0											0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	3	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	3	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.170: *S.* Enteritidis from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	33	0	0						87,9	12,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	33	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	33	0	0,0									54,5	42,4	3,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	33	0	0,0									3,0	45,5	51,5	0,0	0,0	0,0	0,0				
Florfenicol	33	0	0,0									6,1	78,8	15,2	0,0	0,0	0,0	0,0				
Cefotaxime	33	0	0,0				54,5	30,3	15,2	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	33	0	0,0						81,8	18,2	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	33	7	21,2										78,8	0,0	0,0	0,0	0,0	21,2				
Ciprofloxacin	33	7	21,2	3,0	21,2	51,5	3,0	0,0	15,2	3,0	3,0	0,0	0,0	0,0	0,0							
Ampicillin	33	0	0,0							3,0	72,7	21,2	3,0	0,0	0,0	0,0	0,0					
Colistin (1)	33													100,0	0,0	0,0						
Sulfamethoxazole	33	0	0,0											0,0	3,0	21,2	72,7	3,0	0,0	0,0	0,0	0,0
Trimethoprim	33	0	0,0							97,0	3,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	33	0	0,0								42,4	51,5	6,1	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.171: *S.* Infantis from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	20	0	0						80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	20	0	0,0										95,0	5,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	20	4	20,0									0,0	0,0	30,0	15,0	35,0	20,0	0,0	0,0			
Chloramphenicol	20	1	5,0									0,0	30,0	60,0	5,0	0,0	5,0	0,0				
Florfenicol	20	0	0,0									5,0	40,0	45,0	10,0	0,0	0,0	0,0				
Cefotaxime	20	2	10,0				5,0	60,0	20,0	5,0	0,0	0,0	0,0	10,0								
Ceftazidime	20	2	10,0						15,0	55,0	20,0	0,0	0,0	0,0	0,0	10,0						
Nalidixic acid	20	11	55,0										45,0	0,0	0,0	0,0	5,0	50,0				
Ciprofloxacin	20	11	55,0	0,0	5,0	40,0	0,0	0,0	15,0	30,0	10,0	0,0	0,0	0,0	0,0							
Ampicillin	20	4	20,0							0,0	55,0	20,0	5,0	0,0	0,0	0,0	20,0					
Colistin (1)	20													100,0	0,0	0,0						
Sulfamethoxazole	20	14	70,0											0,0	0,0	10,0	20,0	0,0	0,0	0,0	0,0	70,0
Trimethoprim	20	2	10,0							90,0	0,0	0,0	0,0	0,0	0,0	0,0	10,0					
Tetracycline	20	12	60,0								5,0	35,0	0,0	0,0	0,0	0,0	25,0	35,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.172: *S.* Paratyphi B dT+ from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	27	3	11,1						77,8	11,1	0,0	0,0	0,0	0,0	7,4	3,7	0,0					
Kanamycin	27	4	14,8										85,2	0,0	0,0	0,0	0,0	3,7	11,1			
Streptomycin	27	8	29,6									0,0	0,0	0,0	18,5	51,9	3,7	14,8	11,1			
Chloramphenicol	27	5	18,5									7,4	37,0	33,3	3,7	0,0	3,7	14,8				
Florfenicol	27	0	0,0									22,2	55,6	18,5	3,7	0,0	0,0	0,0				
Cefotaxime	27	4	14,8				3,7	40,7	40,7	0,0	0,0	0,0	0,0	14,8								
Ceftazidime	27	4	14,8						7,4	70,4	7,4	0,0	3,7	3,7	0,0	7,4						
Nalidixic acid	27	22	81,5										14,8	0,0	3,7	0,0	0,0	81,5				
Ciprofloxacin	27	23	85,2	0,0	0,0	11,1	3,7	7,4	37,0	33,3	3,7	3,7	0,0	0,0	0,0							
Ampicillin	27	10	37,0							0,0	22,2	33,3	7,4	0,0	0,0	0,0	37,0					
Colistin (1)	27													100,0	0,0	0,0						
Sulfamethoxazole	27	12	44,4											3,7	7,4	37,0	7,4	0,0	0,0	0,0	3,7	40,7
Trimethoprim	27	27	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Tetracycline	27	8	29,6								22,2	40,7	7,4	0,0	0,0	0,0	0,0	29,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.173: *S.* Typhimurium from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	23	0	0						65,2	30,4	4,3	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	23	1	4,3										95,7	0,0	0,0	0,0	0,0	0,0	4,3			
Streptomycin	23	10	43,5									0,0	0,0	13,0	30,4	13,0	17,4	13,0	13,0			
Chloramphenicol	23	8	34,8									4,3	26,1	30,4	4,3	0,0	0,0	34,8				
Florfenicol	23	8	34,8									4,3	52,2	8,7	0,0	8,7	26,1	0,0				
Cefotaxime	23	0	0,0				17,4	56,5	17,4	8,7	0,0	0,0	0,0	0,0								
Ceftazidime	23	0	0,0						39,1	52,2	8,7	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	23	5	21,7										73,9	4,3	0,0	0,0	0,0	21,7				
Ciprofloxacin	23	5	21,7	0,0	4,3	52,2	21,7	0,0	13,0	4,3	4,3	0,0	0,0	0,0	0,0							
Ampicillin	23	9	39,1							0,0	8,7	52,2	0,0	0,0	0,0	0,0	39,1					
Colistin (1)	23													100,0	0,0	0,0						
Sulfamethoxazole	23	10	43,5											0,0	0,0	8,7	47,8	0,0	0,0	0,0	0,0	43,5
Trimethoprim	23	1	4,3							91,3	4,3	0,0	0,0	0,0	0,0	0,0	4,3					
Tetracycline	23	11	47,8								4,3	26,1	21,7	0,0	0,0	26,1	8,7	13,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.3.3.4 Isolates from turkey meat

Tab. 20.174: *Salmonella* spp. from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	78	8	10,3						65,4	24,4	0,0	0,0	0,0	2,6	6,4	1,3	0,0					
Kanamycin	78	15	19,2										79,5	1,3	0,0	5,1	3,8	0,0	10,3			
Streptomycin	78	37	47,4									0,0	5,1	25,6	5,1	16,7	14,1	6,4	26,9			
Chloramphenicol	78	2	2,6									1,3	34,6	51,3	10,3	0,0	0,0	2,6				
Florfenicol	78	2	2,6									6,4	65,4	17,9	7,7	1,3	0,0	1,3				
Cefotaxime	78	2	2,6				29,5	37,2	24,4	6,4	0,0	0,0	0,0	2,6								
Ceftazidime	78	2	2,6						48,7	30,8	15,4	2,6	0,0	2,6	0,0	0,0						
Nalidixic acid	78	23	29,5										61,5	3,8	5,1	1,3	3,8	24,4				
Ciprofloxacin	78	29	37,2	0,0	3,8	46,2	12,8	1,3	7,7	15,4	10,3	2,6	0,0	0,0	0,0							
Ampicillin	78	48	61,5							1,3	14,1	20,5	2,6	0,0	0,0	0,0	61,5					
Colistin (1)	78													100,0	0,0	0,0						
Sulfamethoxazole	78	39	50,0											1,3	1,3	17,9	23,1	6,4	0,0	0,0	0,0	50,0
Trimethoprim	78	12	15,4							78,2	6,4	0,0	0,0	0,0	0,0	0,0	15,4					
Tetracycline	78	52	66,7								3,8	17,9	11,5	0,0	0,0	1,3	10,3	55,1				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.175: *S.* 4,[5],12:i:- from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	15	0	0						86,7	13,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	15	3	20,0										80,0	0,0	0,0	0,0	0,0	0,0	20,0			
Streptomycin	15	15	100,0									0,0	0,0	0,0	0,0	0,0	0,0	6,7	93,3			
Chloramphenicol	15	0	0,0									0,0	13,3	86,7	0,0	0,0	0,0	0,0				
Florfenicol	15	0	0,0									0,0	80,0	20,0	0,0	0,0	0,0	0,0				
Cefotaxime	15	0	0,0				60,0	26,7	13,3	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	15	0	0,0						86,7	13,3	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	15	0	0,0										86,7	13,3	0,0	0,0	0,0	0,0				
Ciprofloxacin	15	0	0,0	0,0	0,0	86,7	13,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	15	15	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	15													100,0	0,0	0,0						
Sulfamethoxazole	15	15	100,0											0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0
Trimethoprim	15	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	15	15	100,0								0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.176: *S.* Enteritidis from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	2	0	0						50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	2	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	2	0	0,0									0,0	50,0	50,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	2	0	0,0									0,0	50,0	50,0	0,0	0,0	0,0	0,0				
Florfenicol	2	0	0,0									50,0	50,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	2	0	0,0				0,0	50,0	50,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	2	0	0,0						0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	2	1	50,0										50,0	0,0	0,0	0,0	50,0	0,0				
Ciprofloxacin	2	1	50,0	0,0	0,0	50,0	0,0	0,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	2	0	0,0							0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	2													100,0	0,0	0,0						
Sulfamethoxazole	2	0	0,0											0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	2	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	2	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.177: *S.* Hadar from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	8	0	0						75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	8	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	8	5	62,5									0,0	0,0	12,5	0,0	25,0	62,5	0,0	0,0			
Chloramphenicol	8	1	12,5									0,0	75,0	0,0	12,5	0,0	0,0	12,5				
Florfenicol	8	1	12,5									12,5	62,5	12,5	0,0	0,0	0,0	12,5				
Cefotaxime	8	0	0,0				37,5	50,0	12,5	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	8	0	0,0						62,5	37,5	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	8	3	37,5										50,0	0,0	12,5	0,0	0,0	37,5				
Ciprofloxacin	8	4	50,0	0,0	0,0	25,0	25,0	0,0	25,0	12,5	12,5	0,0	0,0	0,0	0,0							
Ampicillin	8	1	12,5							12,5	37,5	37,5	0,0	0,0	0,0	0,0	12,5					
Colistin (1)	8													100,0	0,0	0,0						
Sulfamethoxazole	8	2	25,0											12,5	0,0	37,5	25,0	0,0	0,0	0,0	0,0	25,0
Trimethoprim	8	2	25,0							62,5	12,5	0,0	0,0	0,0	0,0	0,0	25,0					
Tetracycline	8	8	100,0								0,0	0,0	0,0	0,0	0,0	0,0	87,5	12,5				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.178: *S.* Newport from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	12	0	0						66,7	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	12	2	16,7										83,3	0,0	0,0	0,0	0,0	0,0	16,7			
Streptomycin	12	0	0,0									0,0	8,3	58,3	16,7	16,7	0,0	0,0	0,0			
Chloramphenicol	12	0	0,0									0,0	41,7	58,3	0,0	0,0	0,0	0,0				
Florfenicol	12	0	0,0									8,3	91,7	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	12	0	0,0				33,3	50,0	16,7	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	12	0	0,0						75,0	16,7	8,3	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	12	3	25,0										75,0	0,0	0,0	0,0	0,0	25,0				
Ciprofloxacin	12	3	25,0	0,0	0,0	58,3	16,7	0,0	0,0	25,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	12	9	75,0							0,0	8,3	16,7	0,0	0,0	0,0	0,0	75,0					
Colistin (1)	12													100,0	0,0	0,0						
Sulfamethoxazole	12	3	25,0											0,0	0,0	50,0	16,7	8,3	0,0	0,0	0,0	25,0
Trimethoprim	12	1	8,3							91,7	0,0	0,0	0,0	0,0	0,0	0,0	8,3					
Tetracycline	12	11	91,7								8,3	0,0	0,0	0,0	0,0	0,0	8,3	83,3				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.179: *S.* Saintpaul from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	18	7	38,9						33,3	27,8	0,0	0,0	0,0	11,1	27,8	0,0	0,0					
Kanamycin	18	7	38,9										61,1	0,0	0,0	22,2	16,7	0,0	0,0			
Streptomycin	18	10	55,6									0,0	0,0	16,7	0,0	27,8	27,8	16,7	11,1			
Chloramphenicol	18	0	0,0									0,0	22,2	55,6	22,2	0,0	0,0	0,0				
Florfenicol	18	0	0,0									0,0	55,6	22,2	22,2	0,0	0,0	0,0				
Cefotaxime	18	0	0,0				11,1	22,2	50,0	16,7	0,0	0,0	0,0	0,0								
Ceftazidime	18	0	0,0						16,7	27,8	44,4	11,1	0,0	0,0	0,0	0,0						
Nalidixic acid	18	8	44,4										38,9	5,6	11,1	0,0	11,1	33,3				
Ciprofloxacin	18	12	66,7	0,0	5,6	22,2	5,6	0,0	5,6	11,1	38,9	11,1	0,0	0,0	0,0							
Ampicillin	18	14	77,8							0,0	0,0	22,2	0,0	0,0	0,0	0,0	77,8					
Colistin (1)	18													100,0	0,0	0,0						
Sulfamethoxazole	18	11	61,1											0,0	0,0	0,0	27,8	11,1	0,0	0,0	0,0	61,1
Trimethoprim	18	4	22,2							61,1	16,7	0,0	0,0	0,0	0,0	0,0	22,2					
Tetracycline	18	9	50,0								0,0	22,2	27,8	0,0	0,0	0,0	0,0	50,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.180: *S.* Typhimurium from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	0	0						80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	5	1	20,0										80,0	0,0	0,0	0,0	0,0	0,0	20,0			
Streptomycin	5	4	80,0									0,0	0,0	20,0	0,0	0,0	20,0	0,0	60,0			
Chloramphenicol	5	1	20,0									0,0	20,0	40,0	20,0	0,0	0,0	20,0				
Florfenicol	5	1	20,0									0,0	60,0	20,0	0,0	20,0	0,0	0,0				
Cefotaxime	5	0	0,0				20,0	40,0	20,0	20,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						40,0	40,0	20,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	5	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	5	4	80,0							0,0	0,0	0,0	20,0	0,0	0,0	0,0	80,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	4	80,0											0,0	0,0	0,0	0,0	20,0	0,0	0,0	0,0	80,0
Trimethoprim	5	1	20,0							80,0	0,0	0,0	0,0	0,0	0,0	0,0	20,0					
Tetracycline	5	4	80,0								0,0	0,0	20,0	0,0	0,0	20,0	0,0	60,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.3.3.5 Isolates from minced meat

Tab. 20.181: *Salmonella* spp. from minced meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	102	2	2,0						70,6	26,5	0,0	1,0	0,0	1,0	1,0	0,0	0,0					
Kanamycin	102	4	3,9										96,1	0,0	1,0	0,0	0,0	0,0	2,9			
Streptomycin	102	51	50,0									1,0	2,9	24,5	15,7	5,9	10,8	12,7	26,5			
Chloramphenicol	102	14	13,7									2,9	26,5	53,9	2,9	0,0	0,0	13,7				
Florfenicol	102	10	9,8									3,9	50,0	33,3	2,9	5,9	3,9	0,0				
Cefotaxime	102	0	0,0				21,6	59,8	16,7	2,0	0,0	0,0	0,0	0,0								
Ceftazidime	102	0	0,0						39,2	51,0	9,8	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	102	5	4,9										91,2	2,9	1,0	0,0	1,0	3,9				
Ciprofloxacin	102	7	6,9	0,0	7,8	73,5	11,8	0,0	1,0	2,0	2,0	2,0	0,0	0,0	0,0							
Ampicillin	102	62	60,8							2,0	23,5	13,7	0,0	0,0	0,0	0,0	60,8					
Colistin (1)	102													100,0	0,0	0,0						
Sulfamethoxazole	102	60	58,8											0,0	4,9	13,7	19,6	2,9	0,0	0,0	0,0	58,8
Trimethoprim	102	18	17,6							81,4	1,0	0,0	0,0	0,0	0,0	0,0	17,6					
Tetracycline	102	63	61,8								4,9	27,5	5,9	0,0	0,0	5,9	5,9	50,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.182: *S.* 4,[5],12:i:- from minced meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	29	0	0						79,3	20,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	29	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	29	25	86,2									0,0	0,0	10,3	3,4	0,0	0,0	27,6	58,6			
Chloramphenicol	29	0	0,0									0,0	41,4	58,6	0,0	0,0	0,0	0,0				
Florfenicol	29	0	0,0									0,0	55,2	44,8	0,0	0,0	0,0	0,0				
Cefotaxime	29	0	0,0				34,5	51,7	13,8	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	29	0	0,0						62,1	34,5	3,4	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	29	0	0,0										96,6	3,4	0,0	0,0	0,0	0,0				
Ciprofloxacin	29	0	0,0	0,0	0,0	82,8	17,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	29	25	86,2							0,0	3,4	10,3	0,0	0,0	0,0	0,0	86,2					
Colistin (1)	29													100,0	0,0	0,0						
Sulfamethoxazole	29	25	86,2											0,0	3,4	0,0	10,3	0,0	0,0	0,0	0,0	86,2
Trimethoprim	29	1	3,4							96,6	0,0	0,0	0,0	0,0	0,0	0,0	3,4					
Tetracycline	29	25	86,2								0,0	10,3	3,4	0,0	0,0	0,0	0,0	86,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.183: *S.* Derby from minced meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3) 0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	14	0	0						78,6	21,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	14	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	14	0	0,0									0,0	0,0	64,3	35,7	0,0	0,0	0,0	0,0			
Chloramphenicol	14	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	14	0	0,0									0,0	42,9	57,1	0,0	0,0	0,0	0,0				
Cefotaxime	14	0	0,0				0,0	85,7	14,3	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	14	0	0,0						7,1	71,4	21,4	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	14	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	14	0	0,0	0,0	0,0	71,4	28,6	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	14	1	7,1							0,0	64,3	28,6	0,0	0,0	0,0	0,0	7,1					
Colistin (1)	14													100,0	0,0	0,0						
Sulfamethoxazole	14	2	14,3											0,0	14,3	35,7	35,7	0,0	0,0	0,0	0,0	14,3
Trimethoprim	14	2	14,3							85,7	0,0	0,0	0,0	0,0	0,0	0,0	14,3					
Tetracycline	14	4	28,6								0,0	57,1	14,3	0,0	0,0	0,0	0,0	28,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.184: *S.* Enteritidis from minced meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3) 0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	1	0	0,0									100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Florfenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	1	0	0,0				100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	1	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	1	1	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	1													100,0	0,0	0,0						
Sulfamethoxazole	1	0	0,0											0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	1	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.185: *S.* Subspec. I rough from minced meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	4	1	25						50,0	25,0	0,0	0,0	0,0	0,0	25,0	0,0	0,0					
Kanamycin	4	1	25,0										75,0	0,0	0,0	0,0	0,0	0,0	25,0			
Streptomycin	4	2	50,0									0,0	25,0	0,0	0,0	25,0	0,0	0,0	50,0			
Chloramphenicol	4	1	25,0									25,0	0,0	25,0	25,0	0,0	0,0	25,0				
Florfenicol	4	0	0,0									25,0	50,0	0,0	25,0	0,0	0,0	0,0				
Cefotaxime	4	0	0,0				0,0	50,0	50,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	4	0	0,0						0,0	75,0	25,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	4	0	0,0										75,0	25,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	4	0	0,0	0,0	0,0	75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	4	4	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	4													100,0	0,0	0,0						
Sulfamethoxazole	4	3	75,0											0,0	0,0	25,0	0,0	0,0	0,0	0,0	0,0	75,0
Trimethoprim	4	2	50,0							50,0	0,0	0,0	0,0	0,0	0,0	0,0	50,0					
Tetracycline	4	3	75,0								0,0	0,0	25,0	0,0	0,0	0,0	0,0	75,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.186: *S.* Typhimurium from minced meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (2)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	25	0	0						60,0	40,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	25	2	8,0										92,0	0,0	0,0	0,0	0,0	0,0	8,0			
Streptomycin	25	17	68,0									0,0	0,0	12,0	16,0	4,0	28,0	16,0	24,0			
Chloramphenicol	25	12	48,0									4,0	16,0	32,0	0,0	0,0	0,0	48,0				
Florfenicol	25	10	40,0									4,0	40,0	16,0	0,0	24,0	16,0	0,0				
Cefotaxime	25	0	0,0				28,0	56,0	12,0	4,0	0,0	0,0	0,0	0,0								
Ceftazidime	25	0	0,0						52,0	40,0	8,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	25	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	25	0	0,0	0,0	12,0	84,0	4,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	25	23	92,0							0,0	8,0	0,0	0,0	0,0	0,0	0,0	92,0					
Colistin (1)	25													100,0	0,0	0,0						
Sulfamethoxazole	25	22	88,0											0,0	0,0	4,0	8,0	0,0	0,0	0,0	0,0	88,0
Trimethoprim	25	8	32,0							68,0	0,0	0,0	0,0	0,0	0,0	0,0	32,0					
Tetracycline	25	21	84,0								0,0	16,0	0,0	0,0	0,0	24,0	20,0	40,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.4 Comparison of *Salmonella* spp. isolates from animals and food

20.4.1 Comparison of the serovars from animals and food

Tab. 20.187: Comparison of the most frequent serovars from animals and meat thereof 2009

	Chicken	Chicken meat	Pig	Pork	Turkey	Turkey meat
	N=315	N=171	N=343	N=148	N=87	N=78
S. Enteritidis	43,2	19,3	2,3	0,7	1,1	2,6
S. Typhimurium	7,9	13,5	45,2	35,8	21,8	6,4
S. 4,[5],12:i:-	3,8	11,1	32,1	25,7	4,6	19,2
S. Derby	0,3	0,0	5,8	8,8	0,0	0,0
S. Saintpaul	1,3	0,0	0,0	0,0	35,6	23,1
S. Heidelberg	0,0	0,0	0,0	0,0	5,7	0,0
S. 4,12:d:-	1,9	1,8	0,0	0,0	1,1	2,6
S. Paratyphi B dT+	1,9	15,8	0,0	0,0	0,0	1,3
Other serovars	39,7	38,6	14,6	29,1	29,9	44,9

20.5 *Salmonella* spp. isolates from animals and food, obtained as part of zoonosis monitoring (2009)

20.5.1 Isolates from animals

Tab. 20.188: Resistance rates in *Salmonella* spp. from laying hens (2009)

	S. Enteritidis	*S.* Typhimurium	*S.* subspec. I rough	*Salmonella* spp.
Tested isolates	N=141	N=11	N=35	N=216
Susceptible	98,6	27,3	100	92,6
Resistent	1,4	72,7	0	7,4
Multiresistant (1)	0,7	72,7	0	5,6
Gentamicin	0,7	0	0	0,5
Kanamycin	0	0	0	0
Streptomycin	0	54,5	0	3,7
Chloramphenicol	0	36,4	0	1,9
Florfenicol	0	36,4	0	1,9
Cefotaxime	0	0	0	0
Ceftazidime	0	0	0	0
Nalidixic acid	0	0	0	0
Ciprofloxacin	0,7	0	0	1,4
Ampicillin	0	72,7	0	5,1
Sulfamethoxazol	0,7	72,7	0	5,6
Trimethoprim	0,7	9,1	0	1,9
Tetracycline	0	63,6	0	4,2

(1) Resistance to more than one class of antimicrobials.

Tab. 20.189: Resistance rates in *Salmonella* spp. from broiler flocks (2009)

	S. Enteritidis	*S.* Typhimurium	*S.* Paratyphi B dT+	*Salmonella* spp.
Tested isolates	N=4	N=2	N=20	N=50
Susceptible	100	0	0	48,0
Resistant	0	100	100	52,0
Multiresistant (1)	0	100	100	50
Gentamicin	0	0	0	0
Kanamycin	0	0	0	0
Streptomycin	0	100	20,0	14,0
Chloramphenicol	0	50,0	5,0	4,0
Florfenicol	0	50,0	0	2,0
Cefotaxime	0	0	5,0	2,0
Ceftazidime	0	0	5,0	2,0
Nalidixic acid	0	0	5,0	2,0
Ciprofloxacin	0	0	80,0	34,0
Ampicillin	0	100	50,0	30
Sulfamethoxazol	0	100	55,0	32,0
Trimethoprim	0	0	100	44,0
Tetracycline	0	100	30,0	18,0

(1) Resistance to more than one class of antimicrobials.

20.5.2 Isolates from food

Tab. 20.190: Resistance rates in *Salmonella* spp. from chicken meat (2009)

	S. Enteritidis	*S.* Typhimurium	*S.* Paratyphi B dT+	*Salmonella* spp.
Tested isolates	N=2	N=7	N=16	N=43
Susceptible	50,0	86,0	0,0	30,2
Resistant	50,0	14,0	100,0	69,8
Multiresistant (1)	0,0	14,0	100,0	62,8
Gentamicin	0,0	0,0	0,0	0,0
Kanamycin	0,0	0,0	12,5	7,0
Streptomycin	0,0	14,3	37,5	23,3
Chloramphenicol	0,0	14,3	12,5	7,0
Florfenicol	0,0	14,3	0,0	2,3
Cefotaxime	0,0	0,0	12,5	4,7
Ceftazidime	0,0	0,0	12,5	4,7
Nalidixic acid	0,0	0,0	12,5	4,7
Ciprofloxacin	50,0	0,0	93,8	51,2
Ampicillin	0,0	14,3	37,5	30,2
Sulfamethoxazol	0,0	14,3	56,3	44,2
Trimethoprim	0,0	14,3	100,0	48,8
Tetracycline	0,0	14,3	43,8	37,2

(1) Resistance to more than one class of antimicrobials.

Tab. 20.191: Resistance rates in *Salmonella* spp. from turkey meat (2009)

	S. Newport	*S.* Saintpaul	*S.* Enteritidis	*S.* Typhimurium	*S.* 4,[5],12:i:-	*Salmonella* spp.
Tested isolates	N=5	N=5	N=1	N=2	N=5	N=30
Susceptible	0,0	20,0	100,0	0,0	0,0	20,0
Resistant	100,0	80,0	0,0	100,0	100,0	80,0
Multiresistant (1)	100,0	80,0	0,0	50,0	100,0	73,3
Gentamicin	0,0	40,0	0,0	0,0	0,0	6,7
Kanamycin	20,0	40,0	0,0	0,0	40,0	26,7
Streptomycin	0,0	40,0	0,0	0,0	100,0	36,7
Chloramphenicol	0,0	0,0	0,0	50,0	0,0	3,3
Florfenicol	0,0	0,0	0,0	50,0	0,0	3,3
Cefotaxime	0,0	0,0	0,0	50,0	0,0	3,3
Ceftazidime	0,0	0,0	0,0	50,0	0,0	3,3
Nalidixic acid	0,0	0,0	0,0	0,0	0,0	3,3
Ciprofloxacin	20,0	60,0	0,0	50,0	0,0	30,0
Ampicillin	80,0	80,0	0,0	50,0	100,0	56,7
Sulfamethoxazol	20,0	40,0	0,0	0,0	100,0	46,7
Trimethoprim	0,0	0,0	0,0	50,0	0,0	3,3
Tetracycline	100,0	40,0	0,0	0,0	100,0	70,0

(1) Resistance to more than one class of antimicrobials.

Tab. 20.192: Resistance rates in *Salmonella* spp. from pork (2009)

	S. 4,[5],12:i:-	*S.* Typhimurium	*Salmonella* spp.
Tested isolates	N=4	N=9	N=18
Susceptible	0,0	0,0	16,7
Resistant	100,0	100,0	83,3
Multiresistant (1)	75,0	78,0	55,6
Gentamicin	0,0	0,0	0,0
Kanamycin	0,0	0,0	0,0
Streptomycin	75,0	77,8	55,6
Chloramphenicol	0,0	33,3	16,7
Florfenicol	0,0	33,3	16,7
Cefotaxime	0,0	0,0	0,0
Ceftazidime	0,0	0,0	0,0
Nalidixic acid	0,0	0,0	0,0
Ciprofloxacin	0,0	0,0	0,0
Ampicillin	75,0	66,7	50,0
Sulfamethoxazol	75,0	77,8	55,6
Trimethoprim	0,0	0,0	0,0
Tetracycline	100,0	77,8	72,2

(1) Resistance to more than one class of antimicrobials.

20.5.3 Distribution of MIC values in Salmonella spp. isolates, obtained as part of zoonosis monitoring (2009)

20.5.3.1 Isolates from animals

Tab. 20.193: *Salmonella* spp. from laying hens (2009)

Antimicrobiol tested	Tested isolates (Number)	Microbiologically resistent isolates (Number) (2)	Microbiological resistent isolates (in%) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	216	1	0,5						88,9	10,6	0,0	0,0	0,5	0,0	0,0	0,0	0,0					
Kanamycin	216	0	0,0										99,5	0,5	0,0	0,0	0,0	0,0	0,0			
Streptomycin	216	8	3,7									53,7	31,5	8,3	2,8	0,0	1,9	0,0	1,9			
Chloramphenicol	216	4	1,9									0,5	44,9	52,8	0,0	0,0	0,0	1,9				
Florfenicol	216	4	1,9									1,9	85,6	10,6	0,0	0,0	1,9	0,0				
Cefotaxime	216	0	0,0				50,0	47,7	2,3	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	216	0	0,0						85,2	13,4	1,4	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	216	2	0,9										99,1	0,0	0,0	0,0	0,0	0,9				
Ciprofloxacin	216	3	1,4	0,5	13,0	82,9	2,3	0,9	0,5	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	216	11	5,1							3,2	76,9	14,8	0,0	0,0	0,0	0,0	5,1					
Colistin (1)	216													100,0	0,0	0,0						
Sulfamethoxazole	216	12	5,6											0,9	0,5	6,0	81,0	6,0	0,0	0,0	0,0	5,6
Trimethoprim	216	4	1,9							96,8	1,4	0,0	0,0	0,0	0,0	0,0	1,9					
Tetracycline	216	9	4,2								22,2	73,6	0,0	0,0	0,0	0,9	1,4	1,9				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.194: *S.* Enteritidis from laying hens (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	141	1	0,7						89,4	9,9	0,0	0,0	0,7	0,0	0,0	0,0	0,0					
Kanamycin	141	0	0,0										99,3	0,7	0,0	0,0	0,0	0,0	0,0			
Streptomycin	141	0	0,0									61,7	36,9	0,7	0,7	0,0	0,0	0,0	0,0			
Chloramphenicol	141	0	0,0									0,7	46,8	52,5	0,0	0,0	0,0	0,0				
Florfenicol	141	0	0,0									0,7	94,3	5,0	0,0	0,0	0,0	0,0				
Cefotaxime	141	0	0,0				56,0	43,3	0,7	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	141	0	0,0						94,3	5,7	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	141	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	141	1	0,7	0,7	12,1	85,1	1,4	0,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	141	0	0,0							3,5	80,9	15,6	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	141													100,0	0,0	0,0						
Sulfamethoxazole	141	1	0,7											0,0	0,0	3,5	89,4	6,4	0,0	0,0	0,0	0,7
Trimethoprim	141	1	0,7							97,9	1,4	0,0	0,0	0,0	0,0	0,0	0,7					
Tetracycline	141	0	0,0								17,0	83,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.195: *S.* Typhimurium from laying hens (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	11	0	0,0						54,5	45,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	11	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	11	6	54,5									0,0	0,0	36,4	9,1	0,0	36,4	0,0	18,2			
Chloramphenicol	11	4	36,4									0,0	18,2	45,5	0,0	0,0	0,0	36,4				
Florfenicol	11	4	36,4									0,0	45,5	18,2	0,0	0,0	36,4	0,0				
Cefotaxime	11	0	0,0				27,3	54,5	18,2	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	11	0	0,0						54,5	36,4	9,1	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	11	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	11	0	0,0	0,0	18,2	81,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	11	8	72,7							0,0	18,2	9,1	0,0	0,0	0,0	0,0	72,7					
Colistin (1)	11													100,0	0,0	0,0						
Sulfamethoxazole	11	8	72,7											0,0	0,0	0,0	27,3	0,0	0,0	0,0	0,0	72,7
Trimethoprim	11	1	9,1							90,9	0,0	0,0	0,0	0,0	0,0	0,0	9,1					
Tetracycline	11	7	63,6								0,0	36,4	0,0	0,0	0,0	18,2	27,3	18,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.
.

Tab. 20.196: *S.* 4,[5],12:i:- from laying hens (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	1	1	100,0									0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0			
Chloramphenicol	1	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	1	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Cefotaxime	1	0	0,0				100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	1	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	1	1	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	1													100,0	0,0	0,0						
Sulfamethoxazole	1	1	100,0											0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0
Trimethoprim	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.197: *S.* Subspec. I rough from laying hens (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	35	0	0,0						94,3	5,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	35	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	35	0	0,0									80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	35	0	0,0									0,0	57,1	42,9	0,0	0,0	0,0	0,0				
Florfenicol	35	0	0,0									8,6	74,3	17,1	0,0	0,0	0,0	0,0				
Cefotaxime	35	0	0,0				45,7	54,3	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	35	0	0,0						88,6	11,4	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	35	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	35	0	0,0	0,0	5,7	85,7	8,6	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	35	0	0,0							5,7	80,0	14,3	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	35													100,0	0,0	0,0						
Sulfamethoxazole	35	0	0,0											0,0	0,0	11,4	85,7	2,9	0,0	0,0	0,0	0,0
Trimethoprim	35	0	0,0							97,1	2,9	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	35	0	0,0								48,6	51,4	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.
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Tab. 20.198: *Salmonella* spp. from broilers (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	50	0	0,0						86,0	12,0	2,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	50	0	0,0										98,0	2,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	50	7	14,0									6,0	12,0	22,0	24,0	22,0	12,0	2,0	0,0			
Chloramphenicol	50	2	4,0									4,0	40,0	48,0	4,0	0,0	2,0	2,0				
Florfenicol	50	1	2,0									8,0	56,0	34,0	0,0	0,0	2,0	0,0				
Cefotaxime	50	1	2,0				26,0	64,0	8,0	0,0	0,0	0,0	0,0	2,0								
Ceftazidime	50	1	2,0						34,0	62,0	2,0	0,0	2,0	0,0	0,0	0,0						
Nalidixic acid	50	17	34,0										62,0	4,0	0,0	0,0	0,0	34,0				
Ciprofloxacin	50	17	34,0	0,0	20,0	46,0	0,0	0,0	26,0	8,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	50	15	30,0							4,0	60,0	6,0	0,0	0,0	0,0	0,0	30,0					
Colistin (1)	50													100,0	0,0	0,0						
Sulfamethoxazole	50	16	32,0											2,0	2,0	26,0	32,0	6,0	0,0	0,0	0,0	32,0
Trimethoprim	50	22	44,0							56,0	0,0	0,0	0,0	0,0	0,0	0,0	44,0					
Tetracycline	50	9	18,0								14,0	68,0	0,0	0,0	0,0	0,0	2,0	16,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.199: *S.* Enteritidis from broilers (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	4	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	4	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	4	0	0,0									75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	4	0	0,0									0,0	50,0	50,0	0,0	0,0	0,0	0,0				
Florfenicol	4	0	0,0									0,0	75,0	25,0	0,0	0,0	0,0	0,0				
Cefotaxime	4	0	0,0				75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	4	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	4	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	4	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	4	0	0,0							0,0	75,0	25,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	4													100,0	0,0	0,0						
Sulfamethoxazole	4	0	0,0											0,0	0,0	50,0	0,0	50,0	0,0	0,0	0,0	0,0
Trimethoprim	4	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	4	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.200: *S.* Typhimurium from broilers (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	2	0	0,0						50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	2	0	0,0										100	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	2	2	100									0,0	0,0	0,0	0,0	0,0	50,0	50,0	0,0			
Chloramphenicol	2	1	50,0									0,0	0,0	50,0	0,0	0,0	0,0	50,0				
Florfenicol	2	1	50,0									0,0	0,0	50,0	0,0	0,0	50,0	0,0				
Cefotaxime	2	0	0,0				50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	2	0	0,0						100	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	2	0	0,0										100	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	2	0	0,0	0,0	0,0	100	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	2	2	100							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100					
Colistin (1)	2													100	0,0	0,0						
Sulfamethoxazole	2	2	100											0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	100
Trimethoprim	2	0	0,0							100	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	2	2	100								0,0	0,0	0,0	0,0	0,0	0,0	50,0	50,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.201: *S.* Paratyphi B dT+ from broilers (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	20	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	20	0	0,0										95,0	5,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	20	4	20,0									0,0	0,0	0,0	25,0	55,0	20,0	0,0	0,0			
Chloramphenicol	20	1	5,0									10,0	65,0	20,0	0,0	0,0	5,0	0,0				
Florfenicol	20	0	0,0									20,0	75,0	5,0	0,0	0,0	0,0	0,0				
Cefotaxime	20	1	5,0				0,0	80,0	15,0	0,0	0,0	0,0	0,0	5,0								
Ceftazidime	20	1	5,0						0,0	90,0	5,0	0,0	5,0	0,0	0,0	0,0						
Nalidixic acid	20	16	80,0										20,0	0,0	0,0	0,0	0,0	80,0				
Ciprofloxacin	20	16	80,0	0,0	0,0	20,0	0,0	0,0	65,0	15,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	20	10	50,0							0,0	50,0	0,0	0,0	0,0	0,0	0,0	50,0					
Colistin (1)	20													100,0	0,0	0,0						
Sulfamethoxazole	20	11	55,0											5,0	5,0	25,0	10,0	0,0	0,0	0,0	0,0	55,0
Trimethoprim	20	20	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Tetracycline	20	6	30,0								30,0	40,0	0,0	0,0	0,0	0,0	0,0	30,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.5.3.2 Isolates from food

Tab. 20.202: *Salmonella* spp. from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	43	0	0,0						93,0	7,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	43	3	7,0										90,7	2,3	0,0	0,0	0,0	0,0	7,0			
Streptomycin	43	10	23,3									2,3	7,0	25,6	7,0	34,9	7,0	9,3	7,0			
Chloramphenicol	43	3	7,0									2,3	37,2	51,2	2,3	0,0	0,0	7,0				
Florfenicol	43	1	2,3									9,3	65,1	23,3	0,0	0,0	2,3	0,0				
Cefotaxime	43	2	4,7				25,6	58,1	9,3	2,3	0,0	0,0	0,0	4,7								
Ceftazidime	43	2	4,7						39,5	51,2	4,7	0,0	0,0	0,0	0,0	4,7						
Nalidixic acid	43	22	51,2										48,8	0,0	0,0	0,0	0,0	51,2				
Ciprofloxacin	43	22	51,2	0,0	11,6	37,2	0,0	0,0	30,2	18,6	2,3	0,0	0,0	0,0	0,0							
Ampicillin	43	13	30,2							2,3	58,1	7,0	2,3	0,0	0,0	0,0	30,2					
Colistin (1)	43													100,0	0,0	0,0						
Sulfamethoxazole	43	19	44,2											2,3	4,7	9,3	37,2	2,3	0,0	2,3	2,3	39,5
Trimethoprim	43	21	48,8							51,2	0,0	0,0	0,0	0,0	0,0	0,0	48,8					
Tetracycline	43	16	37,2								20,9	37,2	4,7	0,0	0,0	2,3	4,7	30,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.203: *S.* Enteritidis from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	2	0	0,0						50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	2	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	2	0	0,0									50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	2	0	0,0									0,0	50,0	50,0	0,0	0,0	0,0	0,0				
Florfenicol	2	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	2	0	0,0				0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	2	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	2	1	50,0										50,0	0,0	0,0	0,0	0,0	50,0				
Ciprofloxacin	2	1	50,0	0,0	0,0	50,0	0,0	0,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	2	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	2													100,0	0,0	0,0						
Sulfamethoxazole	2	0	0,0											0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	2	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	2	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.204: *S.* Typhimurium from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	7	0	0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	7	1	14,3									0,0	14,3	42,9	14,3	14,3	0,0	0,0	14,3			
Chloramphenicol	7	1	14,3									0,0	14,3	71,4	0,0	0,0	0,0	14,3				
Florfenicol	7	1	14,3									14,3	57,1	14,3	0,0	0,0	14,3	0,0				
Cefotaxime	7	0	0,0				85,7	14,3	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	7	0	0,0						85,7	14,3	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	7	0	0,0	0,0	42,9	57,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	7	1	14,3							14,3	71,4	0,0	0,0	0,0	0,0	0,0	14,3					
Colistin (1)	7													100,0	0,0	0,0						
Sulfamethoxazole	7	1	14,3											14,3	0,0	0,0	71,4	0,0	0,0	0,0	0,0	14,3
Trimethoprim	7	1	14,3							85,7	0,0	0,0	0,0	0,0	0,0	0,0	14,3					
Tetracycline	7	1	14,3								42,9	42,9	0,0	0,0	0,0	14,3	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.205: *S.* Paratyphi B dT+ from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	16	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	16	2	12,5										87,5	0,0	0,0	0,0	0,0	0,0	12,5			
Streptomycin	16	6	37,5									0,0	0,0	0,0	6,3	56,3	6,3	18,8	12,5			
Chloramphenicol	16	2	12,5									6,3	31,3	50,0	0,0	0,0	0,0	12,5				
Florfenicol	16	0	0,0									18,8	50,0	31,3	0,0	0,0	0,0	0,0				
Cefotaxime	16	2	12,5				0,0	62,5	18,8	6,3	0,0	0,0	0,0	12,5								
Ceftazidime	16	2	12,5						6,3	75,0	6,3	0,0	0,0	0,0	0,0	12,5						
Nalidixic acid	16	15	93,8										6,3	0,0	0,0	0,0	0,0	93,8				
Ciprofloxacin	16	15	93,8	0,0	0,0	6,3	0,0	0,0	50,0	37,5	6,3	0,0	0,0	0,0	0,0							
Ampicillin	16	6	37,5							0,0	37,5	18,8	6,3	0,0	0,0	0,0	37,5					
Colistin (1)	16													100,0	0,0	0,0						
Sulfamethoxazole	16	9	56,3											0,0	12,5	25,0	6,3	0,0	0,0	0,0	6,3	50,0
Trimethoprim	16	16	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Tetracycline	16	7	43,8								18,8	25,0	12,5	0,0	0,0	0,0	0,0	43,8				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.206: *Salmonella* spp. from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	30	2	6,7						76,7	13,3	0,0	3,3	0,0	6,7	0,0	0,0	0,0					
Kanamycin	30	8	26,7										73,3	0,0	0,0	6,7	0,0	0,0	20,0			
Streptomycin	30	11	36,7									3,3	3,3	26,7	13,3	16,7	6,7	10,0	20,0			
Chloramphenicol	30	1	3,3									0,0	30,0	56,7	10,0	0,0	0,0	3,3				
Florfenicol	30	1	3,3									3,3	56,7	36,7	0,0	0,0	3,3	0,0				
Cefotaxime	30	1	3,3				43,3	30,0	23,3	0,0	0,0	0,0	0,0	3,3								
Ceftazidime	30	1	3,3						60,0	33,3	3,3	0,0	0,0	3,3	0,0	0,0						
Nalidixic acid	30	8	26,7										63,3	6,7	3,3	0,0	0,0	26,7				
Ciprofloxacin	30	9	30,0	0,0	10,0	56,7	3,3	0,0	6,7	6,7	16,7	0,0	0,0	0,0	0,0							
Ampicillin	30	17	56,7							3,3	23,3	16,7	0,0	0,0	0,0	0,0	56,7					
Colistin (1)	30													100,0	0,0	0,0						
Sulfamethoxazole	30	14	46,7											0,0	3,3	23,3	23,3	3,3	0,0	0,0	0,0	46,7
Trimethoprim	30	1	3,3							93,3	3,3	0,0	0,0	0,0	0,0	0,0	3,3					
Tetracycline	30	21	70,0								3,3	20,0	6,7	0,0	3,3	0,0	6,7	60,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.207: *S.* 4,[5],12:i:- from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	0	0						80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	5	2	40,0										60,0	0,0	0,0	0,0	0,0	0,0	40,0			
Streptomycin	5	5	100,0									0,0	0,0	0,0	0,0	0,0	0,0	20,0	80,0			
Chloramphenicol	5	0	0,0									0,0	20,0	80,0	0,0	0,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	80,0	20,0	0,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	0	0,0										60,0	40,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	5	0	0,0	0,0	0,0	80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	5	5	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	5	100,0											0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0
Trimethoprim	5	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	5	5	100,0								0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.208: *S.* Enteritidis from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	1	0	0,0									100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Florfenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	1	0	0,0				0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	1	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	1	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	1													100,0	0,0	0,0						
Sulfamethoxazole	1	0	0,0											0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	1	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.209: *S.* Newport from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	0	0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	5	1	20,0										80,0	0,0	0,0	0,0	0,0	0,0	20,0			
Streptomycin	5	0	0,0									0,0	0,0	40,0	60,0	0,0	0,0	0,0	0,0			
Chloramphenicol	5	0	0,0									0,0	80,0	20,0	0,0	0,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	80,0	20,0	0,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				20,0	80,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						40,0	60,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	1	20,0										80,0	0,0	0,0	0,0	0,0	20,0				
Ciprofloxacin	5	1	20,0	0,0	0,0	80,0	0,0	0,0	0,0	0,0	20,0	0,0	0,0	0,0	0,0							
Ampicillin	5	4	80,0							0,0	0,0	20,0	0,0	0,0	0,0	0,0	80,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	1	20,0											0,0	0,0	80,0	0,0	0,0	0,0	0,0	0,0	20,0
Trimethoprim	5	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	5	5	100,0								0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.210: *S.* Saintpaul from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	5	2	40						40,0	20,0	0,0	0,0	0,0	40,0	0,0	0,0	0,0					
Kanamycin	5	2	40,0										60,0	0,0	0,0	40,0	0,0	0,0	0,0			
Streptomycin	5	2	40,0									0,0	0,0	20,0	0,0	40,0	0,0	20,0	20,0			
Chloramphenicol	5	0	0,0									0,0	0,0	60,0	40,0	0,0	0,0	0,0				
Florfenicol	5	0	0,0									0,0	60,0	40,0	0,0	0,0	0,0	0,0				
Cefotaxime	5	0	0,0				60,0	0,0	40,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	5	0	0,0						60,0	20,0	20,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	5	2	40,0										40,0	0,0	20,0	0,0	0,0	40,0				
Ciprofloxacin	5	3	60,0	0,0	20,0	20,0	0,0	0,0	0,0	20,0	40,0	0,0	0,0	0,0	0,0							
Ampicillin	5	4	80,0							0,0	20,0	0,0	0,0	0,0	0,0	0,0	80,0					
Colistin (1)	5													100,0	0,0	0,0						
Sulfamethoxazole	5	2	40,0											0,0	0,0	0,0	60,0	0,0	0,0	0,0	0,0	40,0
Trimethoprim	5	0	0,0							80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	5	2	40,0								0,0	20,0	40,0	0,0	0,0	0,0	0,0	40,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.211: *S.* Typhimurium from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	2	0	0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	2	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	2	1	50,0									0,0	0,0	50,0	0,0	0,0	0,0	50,0	0,0			
Chloramphenicol	2	1	50,0									0,0	0,0	50,0	0,0	0,0	0,0	50,0				
Florfenicol	2	1	50,0									0,0	50,0	0,0	0,0	0,0	50,0	0,0				
Cefotaxime	2	0	0,0				50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	2	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	2	1	50,0										50,0	0,0	0,0	0,0	0,0	50,0				
Ciprofloxacin	2	1	50,0	0,0	0,0	50,0	0,0	0,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	2	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	2													100,0	0,0	0,0						
Sulfamethoxazole	2	1	50,0											0,0	0,0	0,0	0,0	50,0	0,0	0,0	0,0	50,0
Trimethoprim	2	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	2	2	100,0								0,0	0,0	0,0	0,0	50,0	0,0	50,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.212: *S.* Dublin from veal (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	1	0	0,0									0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0			
Chloramphenicol	1	0	0,0									0,0	0,0	100,0	0,0	0,0	0,0	0,0				
Florfenicol	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Cefotaxime	1	0	0,0				0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	1	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	1	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	1	0	0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	1	0	0,0							0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0					
Colistin (1)	1													100,0	0,0	0,0						
Sulfamethoxazole	1	0	0,0											0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	1	0	0,0								100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.213: *Salmonella* spp. from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	18	0	0,0						77,8	16,7	5,6	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	18	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	18	10	55,6									0,0	11,1	27,8	5,6	0,0	11,1	11,1	33,3			
Chloramphenicol	18	3	16,7									0,0	11,1	61,1	11,1	0,0	0,0	16,7				
Florfenicol	18	3	16,7									0,0	38,9	44,4	0,0	0,0	16,7	0,0				
Cefotaxime	18	0	0,0				38,9	50,0	11,1	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	18	0	0,0						72,2	27,8	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	18	0	0,0										88,9	11,1	0,0	0,0	0,0	0,0				
Ciprofloxacin	18	0	0,0	0,0	16,7	61,1	22,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	18	9	50,0							0,0	44,4	5,6	0,0	0,0	0,0	0,0	50,0					
Colistin (1)	18													100,0	0,0	0,0						
Sulfamethoxazole	18	10	55,6											0,0	5,6	5,6	33,3	0,0	0,0	0,0	0,0	55,6
Trimethoprim	18	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	18	13	72,2								0,0	22,2	5,6	0,0	0,0	16,7	11,1	44,4				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.
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Tab. 20.214: *S.* 4,[5],12:i:- from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	4	0	0						75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	4	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	4	3	75,0									0,0	25,0	0,0	0,0	0,0	0,0	0,0	75,0			
Chloramphenicol	4	0	0,0									0,0	25,0	75,0	0,0	0,0	0,0	0,0				
Florfenicol	4	0	0,0									0,0	75,0	25,0	0,0	0,0	0,0	0,0				
Cefotaxime	4	0	0,0				50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	4	0	0,0						50,0	50,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	4	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	4	0	0,0	0,0	0,0	75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	4	3	75,0							0,0	25,0	0,0	0,0	0,0	0,0	0,0	75,0					
Colistin (1)	4													100,0	0,0	0,0						
Sulfamethoxazole	4	3	75,0											0,0	0,0	0,0	25,0	0,0	0,0	0,0	0,0	75,0
Trimethoprim	4	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	4	4	100,0								0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.215: *S*. Typhimurium from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
				Distribution (%) of MICs (µg/ml) (3)																		
Gentamicin	9	0	0						88,9	0,0	11,1	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	9	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	9	7	77,8									0,0	11,1	11,1	0,0	0,0	22,2	22,2	33,3			
Chloramphenicol	9	3	33,3									0,0	11,1	33,3	22,2	0,0	0,0	33,3				
Florfenicol	9	3	33,3									0,0	11,1	55,6	0,0	0,0	33,3	0,0				
Cefotaxime	9	0	0,0				44,4	33,3	22,2	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	9	0	0,0						66,7	33,3	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	9	0	0,0										77,8	22,2	0,0	0,0	0,0	0,0				
Ciprofloxacin	9	0	0,0	0,0	0,0	66,7	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	9	6	66,7							0,0	22,2	11,1	0,0	0,0	0,0	0,0	66,7					
Colistin (1)	9													100,0	0,0	0,0						
Sulfamethoxazole	9	7	77,8											0,0	0,0	11,1	11,1	0,0	0,0	0,0	0,0	77,8
Trimethoprim	9	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	9	7	77,8								0,0	11,1	11,1	0,0	0,0	33,3	22,2	22,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.6 *Campylobacter* spp. from amimals and food, obtained as part of the zoonosis monitoring (2009)

20.6.1 Isolates from animals

Tab. 20.216: Resistance rates in *C. jejuni* und *C. coli* from animals (2009)

	Laying hens		Broiler		Veal calves	
	C. jejuni	*C. coli*	*C. jejuni*	*C. coli*	*C. jejuni*	*C. coli*
Tested isolates	N=73	N=45	N=20	N=6	N=83	N=31
Susceptible	45,2	26,7	20	0	22,9	0
Resistant	54,8	73,3	80	100	77,1	100
Multiresistant (1)	28,8	42,2	18	66,7	30,1	100
Gentamicin	0	0	0	0	0	0
Streptomycin	5,5	8,9	5	33,3	3,6	67,7
Chloramphenicol	0	0	0	0	0	0
Ciprofloxacin	45,2	57,8	65	66,7	37,3	77,4
Nalidixic acid	38,4	40	55	33,3	37,3	54,8
Erythromycin	0	2,2	5	16,7	0	0
Tetracycline	37	55,6	30	83,3	67,5	96,8

(1) Resistance to more than one class of antimicrobials.

20.6.2 Isolates from meat

Tab. 20.217: Resistance rate inC. *jejuni* und *C. coli* from meat (2009)

	Chicken meat		Turkey meat	
	C. jejuni	*C. coli*	*C. jejuni*	*C. coli*
Tested isolates	N=116	N=52	N=35	N=0
Susceptible	42,2	17,3	20	0
Resistant	57,8	82,7	80	100
Multiresistant (1)	26,7	59,6	45,7	0
Gentamicin	0	0	0	0
Streptomycin	6	26,9	8,6	0
Chloramphenicol	0	0	0	0
Ciprofloxacin	45,7	67,3	65,7	0
Nalidixic acid	38,8	48,1	54,3	0
Erythromycin		15,4	2,9	0
Tetracycline	36,2	61,5	60	0

(1) Resistance to more than one class of antimicrobials.

20.7 Distribution of MIC values *Campylobacter* isolates, obtained as part of the zoonosis monitoring (2009)

20.7.1.1 Isolates from animals

Tab. 20.218: *Campylobacter jejuni* from laying hens (2009)

				Distribution (%) of MICs (µg/ml) (2)																		
Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	73	0	0					15,1	58,9	24,7	1,4	0,0	0,0	0,0	0,0	0,0						
Streptomycin	73	4	5,5								91,8	2,7	1,4	0,0	1,4	2,7						
Chloramphenicol	73	0	0,0									90,4	9,6	0,0	0,0	0,0	0,0					
Ciprofloxacin	73	33	45,2				8,2	28,8	11,0	6,8	0,0	1,4	5,5	38,4								
Nalidixic acid	73	28	38,4									13,7	32,9	6,8	8,2	16,4	13,7	8,2				
Erythromycin	73	0	0,0							93,2	6,8	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	73	27	37,0						49,3	12,3	1,4	0,0	0,0	1,4	12,3	23,3						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.219: *Campylobacter coli* from laying hens (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (2)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	45	0	0					4,4	28,9	62,2	4,4	0,0	0,0	0,0	0,0	0,0						
Streptomycin	45	4	8,9								71,1	20,0	0,0	0,0	0,0	8,9						
Chloramphenicol	45	0	0,0									84,4	15,6	0,0	0,0	0,0	0,0					
Ciprofloxacin	45	26	57,8				2,2	15,6	22,2	2,2	0,0	0,0	0,0	57,8								
Nalidixic acid	45	18	40,0									6,7	24,4	11,1	2,2	15,6	37,8	2,2				
Erythromycin	45	1	2,2							64,4	22,2	8,9	0,0	0,0	2,2	0,0	2,2					
Tetracycline	45	25	55,6						44,4	0,0	0,0	0,0	0,0	6,7	0,0	48,9						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.220: *Campylobacter jejuni* from broilers (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (2)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	20	0	0					15,0	40,0	45,0	0,0	0,0	0,0	0,0	0,0	0,0						
Streptomycin	20	1	5,0								95,0	0,0	0,0	5,0	0,0	0,0						
Chloramphenicol	20	0	0,0									65,0	25,0	10,0	0,0	0,0	0,0					
Ciprofloxacin	20	13	65,0				5,0	15,0	10,0	5,0	0,0	0,0	10,0	55,0								
Nalidixic acid	20	11	55,0									10,0	25,0	0,0	10,0	10,0	30,0	15,0				
Erythromycin	20	1	5,0							75,0	15,0	0,0	5,0	0,0	0,0	0,0	5,0					
Tetracycline	20	6	30,0						45,0	5,0	5,0	15,0	0,0	0,0	0,0	30,0						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.221: *Campylobacter coli* from broilers (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (2)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	6	0	0					16,7	16,7	66,7	0,0	0,0	0,0	0,0	0,0	0,0						
Streptomycin	6	2	33,3								66,7	0,0	0,0	0,0	0,0	33,3						
Chloramphenicol	6	0	0,0									66,7	33,3	0,0	0,0	0,0	0,0					
Ciprofloxacin	6	4	66,7				16,7	16,7	0,0	0,0	0,0	0,0	0,0	66,7								
Nalidixic acid	6	2	33,3									0,0	33,3	0,0	0,0	33,3	33,3	0,0				
Erythromycin	6	1	16,7							66,7	16,7	0,0	0,0	0,0	0,0	0,0	16,7					
Tetracycline	6	5	83,3						16,7	0,0	0,0	0,0	0,0	0,0	0,0	83,3						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.222: ***Campylobacter jejuni*** **from veal calves (2009)**

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (2)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	83	0	0					3,6	44,6	50,6	1,2	0,0	0,0	0,0	0,0	0,0						
Streptomycin	83	3	3,6								89,2	7,2	0,0	1,2	0,0	2,4						
Chloramphenicol	83	0	0,0									94,0	4,8	1,2	0,0	0,0	0,0					
Ciprofloxacin	83	31	37,3				3,6	37,3	16,9	2,4	2,4	1,2	0,0	36,1								
Nalidixic acid	83	31	37,3									19,3	30,1	10,8	2,4	7,2	15,7	14,5				
Erythromycin	83	0	0,0							73,5	21,7	4,8	0,0	0,0	0,0	0,0	0,0					
Tetracycline	83	56	67,5						27,7	3,6	0,0	1,2	1,2	1,2	18,1	47,0						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.223: ***Campylobacter coli*** **from veal calves (2009)**

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (2)																		
				0,008	**0,015**	**0,03125**	**0,0625**	**0,125**	**0,25**	**0,5**	**1**	**2**	**4**	**8**	**16**	**32**	**64**	**128**	**256**	**512**	**1024**	**2048**
Gentamicin	31	0	0					0,0	25,8	54,8	19,4	0,0	0,0	0,0	0,0	0,0						
Streptomycin	31	21	67,7								9,7	19,4	3,2	0,0	0,0	67,7						
Chloramphenicol	31	0	0,0									45,2	54,8	0,0	0,0	0,0	0,0					
Ciprofloxacin	31	24	77,4				0,0	16,1	3,2	3,2	0,0	0,0	0,0	77,4								
Nalidixic acid	31	17	54,8									0,0	12,9	12,9	0,0	19,4	32,3	22,6				
Erythromycin	31	0	0,0							9,7	54,8	29,0	6,5	0,0	0,0	0,0	0,0					
Tetracycline	31	30	96,8						3,2	0,0	0,0	0,0	0,0	0,0	0,0	96,8						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

20.7.1.2 Isolates from food

Tab. 20.224: *Campylobacter jejuni* from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
				Distribution (%) of MICs (µg/ml) (2)																		
Gentamicin	116	0	0					11,2	50,0	35,3	3,4	0,0	0,0	0,0	0,0	0,0						
Streptomycin	116	7	6,0								90,5	3,4	1,7	0,0	0,0	4,3						
Chloramphenicol	116	0	0,0									92,2	7,8	0,0	0,0	0,0	0,0					
Ciprofloxacin	116	53	45,7				8,6	33,6	10,3	0,9	0,9	0,0	3,4	42,2								
Nalidixic acid	116	45	38,8									29,3	21,6	6,0	4,3	12,9	18,1	7,8				
Erythromycin	116	0	0,0							88,8	8,6	2,6	0,0	0,0	0,0	0,0	0,0					
Tetracycline	116	42	36,2						56,0	2,6	4,3	0,9	0,0	0,9	1,7	33,6						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.225: *Campylobacter coli* from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
				Distribution (%) of MICs (µg/ml) (2)																		
Gentamicin	52	0	0					1,9	26,9	63,5	7,7	0,0	0,0	0,0	0,0	0,0						
Streptomycin	52	14	26,9								48,1	21,2	3,8	0,0	0,0	26,9						
Chloramphenicol	52	0	0,0									86,5	13,5	0,0	0,0	0,0	0,0					
Ciprofloxacin	52	35	67,3				3,8	15,4	13,5	0,0	0,0	0,0	3,8	63,5								
Nalidixic acid	52	25	48,1									5,8	19,2	7,7	3,8	15,4	40,4	7,7				
Erythromycin	52	8	15,4							48,1	28,8	5,8	1,9	0,0	0,0	0,0	15,4					
Tetracycline	52	32	61,5						34,6	3,8	0,0	0,0	0,0	0,0	1,9	59,6						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.226: *Campylobacter jejuni* from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
				Distribution (%) of MICs (µg/ml) (2)																		
Gentamicin	35	0	0					17,1	57,1	25,7	0,0	0,0	0,0	0,0	0,0	0,0						
Streptomycin	35	3	8,6								88,6	2,9	0,0	0,0	0,0	8,6						
Chloramphenicol	35	0	0,0									91,4	8,6	0,0	0,0	0,0	0,0					
Ciprofloxacin	35	23	65,7				5,7	22,9	5,7	0,0	0,0	5,7	5,7	54,3								
Nalidixic acid	35	19	54,3									17,1	17,1	5,7	5,7	17,1	22,9	14,3				
Erythromycin	35	1	2,9							91,4	5,7	0,0	0,0	0,0	0,0	0,0	2,9					
Tetracycline	35	21	60,0						37,1	2,9	0,0	0,0	0,0	5,7	20,0	34,3						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.227: *Campylobacter coli* from veal (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (2)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0					0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0						
Streptomycin	1	1	100,0								0,0	0,0	0,0	0,0	0,0	100,0						
Chloramphenicol	1	0	0,0									100,0	0,0	0,0	0,0	0,0	0,0					
Ciprofloxacin	1	1	100,0				0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0								
Nalidixic acid	1	1	100,0									0,0	0,0	0,0	0,0	0,0	100,0	0,0				
Erythromycin	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	1	1	100,0						0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

Tab. 20.228: *Campylobacter coli* from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (2)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	1	0	0					0,0	0,0	0,0	100,0	0,0	0,0	0,0	0,0	0,0						
Streptomycin	1	0	0,0								0,0	100,0	0,0	0,0	0,0	0,0						
Chloramphenicol	1	0	0,0									100,0	0,0	0,0	0,0	0,0	0,0					
Ciprofloxacin	1	0	0,0				0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0								
Nalidixic acid	1	0	0,0									0,0	100,0	0,0	0,0	0,0	0,0	0,0				
Erythromycin	1	1	100,0							0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0					
Tetracycline	1	1	100,0						0,0	0,0	0,0	0,0	0,0	0,0	100,0	0,0						

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.

20.7.2 Commensal E. coli isolates, obtained as part of the zoonosis monitoring (2009)

20.7.2.1 Isolates from animals

Tab. 20.229: Resistance rates in commensal *E. coli* from animals (2009)

	Laying hens	Broilers	Dairy cattle	Veal calves
Tested isolates	312	202	93	361
Susceptible	59,6	15,3	83,9	27,1
Resistant	40,4	84,7	16,1	72,9
Multiresistant (1)	23,4	72,8	5,5	69,0
Gentamicin	2,2	6,4	1,1	7,5
Kanamycin	9,0	16,8	2,2	23,3
Streptomycin	10,6	42,6	4,3	52,4
Chloramphenicol	2,9	14,4	1,1	21,1
Florfenicol	0,6	1,5	1,1	4,7
Cefotaxime	1,3	5,4	0	1,4
Ceftazidime	1,3	5,9	0	3,0
Nalidixic acid	8,0	41,1	1,1	10,5
Ciprofloxacin	8,7	43,1	2,2	13,3
Ampicillin	22,8	64,4	4,3	59,0
Sulfamethoxazol	21,5	65,3	11,8	65,1
Trimethoprim	11,2	48,0	3,2	56,5
Tetracycline	18,3	36,1	4,3	65,9

(1) Resistance to more than one class of antimicrobials.

20.7.2.2 Isolates from meat

Tab. 20.230: Resistance rates in commensal *E. coli* from meat (2009)

	Veal	Pork	Chicken meat	Turkey meat
Tested isolates	51	46	194	203
Susceptible	37,3	56,5	10,8	6,9
Resistant	62,7	43,5	89,2	93,1
Multiresistant (1)	51,1	32,6	73,7	84,2
Gentamicin	2,0	2,2	7,7	6,4
Kanamycin	17,6	4,3	17,0	24,6
Streptomycin	39,2	32,6	41,2	53,7
Chloramphenicol	19,6	6,5	16,5	34,5
Florfenicol	5,9	2,2	1,5	2,0
Cefotaxime	0	2,2	6,2	1,0
Ceftazidime	0	2,2	6,2	1,0
Nalidixic acid	3,9	6,5	50,5	26,1
Ciprofloxacin	3,9	6,5	53,1	30,0
Ampicillin	41,2	23,9	59,3	78,8
Sulfamethoxazol	51,0	21,7	61,3	67,5
Trimethoprim	35,3	15,2	49,0	38,9
Tetracycline	52,9	28,3	45,4	82,8

(1) Resistance to more than one class of antimicrobials.

20.7.3 Distribution of MIC values from commensal E. coli isolates, obtained as part of the zoonosis monitoring (2009)

20.7.3.1 Isolates from animals

Tab. 20.231: *E. coli* from laying hens (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	312	7	2,2						49,0	41,0	6,1	1,6	0,3	0,3	0,6	0,3	0,6					
Kanamycin	312	28	9,0										88,8	2,2	0,3	0,0	0,0	0,0	8,7			
Streptomycin	312	33	10,6									0,6	42,6	40,1	6,1	1,3	1,9	1,9	5,4			
Chloramphenicol	312	9	2,9									1,6	33,7	59,3	2,6	0,0	1,6	1,3				
Florfenicol	312	2	0,6									3,2	45,2	46,8	4,2	0,3	0,0	0,3				
Cefotaxime	312	4	1,3				78,2	19,2	1,3	0,3	0,0	0,0	0,0	1,0								
Ceftazidime	312	4	1,3						94,2	4,5	0,3	0,3	0,0	0,6	0,0	0,0						
Nalidixic acid	312	25	8,0										91,3	0,6	0,0	0,6	1,6	5,8				
Ciprofloxacin	312	27	8,7	3,2	64,7	23,4	1,3	0,6	3,8	2,2	0,0	0,0	0,0	0,0	0,6							
Ampicillin	312	71	22,8							0,3	4,2	38,8	33,0	1,0	0,0	0,0	22,8					
Colistin (1)	312													100,0	0,0	0,0						
Sulfamethoxazole	312	67	21,5											46,8	22,1	7,4	2,2	0,0	0,0	0,0	0,0	21,5
Trimethoprim	312	35	11,2							86,2	2,2	0,3	0,0	0,0	0,0	0,3	10,9					
Tetracycline	312	57	18,3								40,4	39,1	2,2	0,0	0,0	0,0	7,1	11,2				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.232: *E. coli* from broilers (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	202	13	6,4						49,0	31,7	12,4	0,5	0,5	0,0	3,5	1,0	1,5					
Kanamycin	202	34	16,8										78,7	4,5	0,0	0,0	0,5	0,5	15,8			
Streptomycin	202	86	42,6									2,0	25,7	24,3	5,4	6,4	6,9	9,4	19,8			
Chloramphenicol	202	29	14,4									1,0	32,2	47,0	5,4	2,0	5,0	7,4				
Florfenicol	202	3	1,5									2,0	41,6	45,0	9,9	1,0	0,0	0,5				
Cefotaxime	202	11	5,4				70,3	20,3	4,0	0,5	0,5	0,0	1,0	3,5								
Ceftazidime	202	12	5,9						83,7	10,4	1,5	1,5	0,5	2,0	0,5	0,0						
Nalidixic acid	202	83	41,1										57,4	1,0	0,5	2,5	3,5	35,1				
Ciprofloxacin	202	87	43,1	0,5	41,6	14,9	0,5	5,4	10,9	7,9	5,0	2,5	1,0	3,5	6,4							
Ampicillin	202	130	64,4							0,5	3,0	16,3	13,4	2,5	0,0	0,0	64,4					
Colistin (1)	202													100,0	0,0	0,0						
Sulfamethoxazole	202	132	65,3											24,8	5,9	3,0	1,0	0,0	0,0	0,0	0,5	64,9
Trimethoprim	202	97	48,0							49,0	2,0	1,0	0,0	0,0	0,0	0,0	48,0					
Tetracycline	202	73	36,1								27,2	34,2	2,5	0,0	0,0	1,0	13,4	21,8				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.233: *E. coli* from dairy cattle (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	93	1	1,1						45,2	46,2	7,5	0,0	1,1	0,0	0,0	0,0	0,0					
Kanamycin	93	2	2,2										93,5	4,3	0,0	0,0	0,0	0,0	2,2			
Streptomycin	93	4	4,3									0,0	53,8	37,6	4,3	0,0	0,0	2,2	2,2			
Chloramphenicol	93	1	1,1									1,1	21,5	75,3	1,1	0,0	0,0	1,1				
Florfenicol	93	1	1,1									0,0	37,6	59,1	2,2	0,0	0,0	1,1				
Cefotaxime	93	0	0,0				86,0	14,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	93	0	0,0						90,3	9,7	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	93	1	1,1										97,8	1,1	0,0	0,0	0,0	1,1				
Ciprofloxacin	93	2	2,2	2,2	66,7	29,0	1,1	1,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	93	4	4,3							0,0	5,4	36,6	52,7	1,1	0,0	0,0	4,3					
Colistin (1)	93													100,0	0,0	0,0						
Sulfamethoxazole	93	11	11,8											49,5	25,8	10,8	2,2	0,0	0,0	0,0	0,0	11,8
Trimethoprim	93	3	3,2							90,3	6,5	0,0	1,1	0,0	0,0	0,0	2,2					
Tetracycline	93	4	4,3								26,9	64,5	4,3	0,0	0,0	0,0	4,3	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.234: *E. coli* from veal calves (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	361	27	7,4792						46,8	33,5	10,5	1,7	0,0	1,7	2,8	1,7	1,4					
Kanamycin	361	84	23,3										73,4	3,3	0,6	0,3	0,3	0,0	22,2			
Streptomycin	361	189	52,4									0,8	19,7	18,6	8,6	6,1	15,0	11,6	19,7			
Chloramphenicol	361	76	21,1									1,1	23,0	48,5	6,4	2,5	3,0	15,5				
Florfenicol	361	17	4,7									2,2	29,6	46,5	16,9	0,6	0,3	3,9				
Cefotaxime	361	5	1,4				67,0	27,7	3,9	0,0	0,0	0,0	0,0	1,4								
Ceftazidime	361	11	3,0						87,3	9,7	2,5	0,0	0,3	0,3	0,0	0,0						
Nalidixic acid	361	38	10,5										88,1	1,4	0,0	0,3	1,4	8,9				
Ciprofloxacin	361	48	13,3	3,6	51,8	31,3	3,0	0,8	3,6	1,9	0,0	0,6	0,0	0,6	2,8							
Ampicillin	361	213	59,0							0,0	2,5	22,7	15,0	0,8	0,0	0,3	58,7					
Colistin (1)	361													100,0	0,0	0,0						
Sulfamethoxazole	361	235	65,1											18,0	13,9	2,2	0,8	0,0	0,0	0,0	0,0	65,1
Trimethoprim	361	204	56,5							40,4	3,0	0,0	0,3	0,0	0,0	0,0	56,2					
Tetracycline	361	238	65,9								15,0	16,6	1,9	0,6	0,3	1,4	15,2	49,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.7.3.2 Isolates from food

Tab. 20.235: *E. coli* from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3) 0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	194	15	7,7						40,2	39,2	11,3	1,5	0,0	2,1	4,1	0,5	1,0					
Kanamycin	194	33	17,0										75,8	7,2	0,5	0,0	1,0	0,5	14,9			
Streptomycin	194	80	41,2									0,5	26,3	23,7	8,2	5,2	11,3	8,8	16,0			
Chloramphenicol	194	32	16,5									3,6	47,4	32,0	0,5	1,5	3,1	11,9				
Florfenicol	194	3	1,5									6,2	52,1	36,1	4,1	0,0	1,0	0,5				
Cefotaxime	194	12	6,2				72,2	19,1	2,6	0,0	0,0	0,5	0,5	5,2								
Ceftazidime	194	12	6,2						85,6	8,2	0,0	1,5	0,5	3,6	0,5	0,0						
Nalidixic acid	194	98	50,5										48,5	0,0	1,0	3,6	10,8	36,1				
Ciprofloxacin	194	103	53,1	1,0	28,9	17,0	1,0	2,6	22,7	12,9	2,6	1,0	1,5	2,6	6,2							
Ampicillin	194	115	59,3							0,0	4,6	18,6	16,5	1,0	0,0	0,0	59,3					
Colistin (1)	194													100,0	0,0	0,0						
Sulfamethoxazole	194	119	61,3											19,1	15,5	4,1	0,0	0,0	0,0	0,0	0,5	60,8
Trimethoprim	194	95	49,0							48,5	2,1	0,5	0,5	0,0	0,0	0,0	48,5					
Tetracycline	194	88	45,4								28,9	24,7	1,0	0,0	0,0	1,0	24,2	20,1				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.236: *E. coli* from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3) 0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	203	13	6,4						33,5	44,8	14,3	1,0	0,0	0,5	1,5	1,0	3,4					
Kanamycin	203	50	24,6										70,4	4,9	0,0	0,0	0,0	0,0	24,6			
Streptomycin	203	109	53,7									1,0	16,7	19,2	9,4	13,3	5,4	10,3	24,6			
Chloramphenicol	203	70	34,5									2,0	33,0	28,6	2,0	10,8	7,4	16,3				
Florfenicol	203	4	2,0									2,0	44,3	39,4	12,3	0,5	0,5	1,0				
Cefotaxime	203	2	1,0				69,0	27,1	3,0	0,0	0,0	0,0	0,0	1,0								
Ceftazidime	203	2	1,0						94,1	4,9	0,5	0,0	0,5	0,0	0,0	0,0						
Nalidixic acid	203	53	26,1										72,4	1,5	0,0	0,5	3,9	21,7				
Ciprofloxacin	203	61	30,0	3,4	36,0	30,5	1,0	3,0	8,9	5,9	1,5	0,5	0,5	0,5	8,4							
Ampicillin	203	160	78,8							0,0	2,0	10,3	8,9	0,0	0,0	0,0	78,8					
Colistin (1)	203													99,5	0,5	0,0						
Sulfamethoxazole	203	137	67,5											20,2	9,9	2,5	0,0	0,0	0,0	0,0	0,0	67,5
Trimethoprim	203	79	38,9							57,1	3,0	1,0	0,0	0,0	0,0	0,0	38,9					
Tetracycline	203	168	82,8								7,9	8,4	1,0	0,0	0,0	3,0	32,5	47,3				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.237: *E. coli* from veal (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	51	1	2,0						47,1	33,3	15,7	2,0	0,0	0,0	0,0	0,0	2,0					
Kanamycin	51	9	17,6										74,5	7,8	0,0	0,0	0,0	0,0	17,6			
Streptomycin	51	20	39,2									3,9	25,5	23,5	7,8	3,9	9,8	15,7	9,8			
Chloramphenicol	51	10	19,6									0,0	29,4	41,2	9,8	3,9	7,8	7,8				
Florfenicol	51	3	5,9									2,0	37,3	47,1	7,8	3,9	0,0	2,0				
Cefotaxime	51	0	0,0				68,6	29,4	2,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	51	0	0,0						94,1	5,9	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	51	2	3,9										96,1	0,0	0,0	0,0	0,0	3,9				
Ciprofloxacin	51	2	3,9	7,8	54,9	33,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	3,9							
Ampicillin	51	21	41,2							0,0	5,9	23,5	27,5	2,0	0,0	0,0	41,2					
Colistin (1)	51													100,0	0,0	0,0						
Sulfamethoxazole	51	26	51,0											31,4	7,8	9,8	0,0	0,0	0,0	0,0	0,0	51,0
Trimethoprim	51	18	35,3							60,8	3,9	0,0	0,0	0,0	0,0	0,0	35,3					
Tetracycline	51	27	52,9								23,5	23,5	0,0	0,0	0,0	0,0	17,6	35,3				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.238: *E. coli* from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	46	1	2,2						39,1	47,8	10,9	0,0	0,0	2,2	0,0	0,0	0,0					
Kanamycin	46	2	4,3										91,3	4,3	0,0	0,0	0,0	0,0	4,3			
Streptomycin	46	15	32,6									2,2	30,4	30,4	4,3	8,7	10,9	6,5	6,5			
Chloramphenicol	46	3	6,5									2,2	39,1	50,0	2,2	0,0	2,2	4,3				
Florfenicol	46	1	2,2									8,7	39,1	47,8	2,2	0,0	0,0	2,2				
Cefotaxime	46	1	2,2				93,5	2,2	2,2	2,2	0,0	0,0	0,0	0,0								
Ceftazidime	46	1	2,2						93,5	4,3	2,2	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	46	3	6,5										93,5	0,0	0,0	0,0	0,0	6,5				
Ciprofloxacin	46	3	6,5	15,2	50,0	28,3	0,0	2,2	2,2	0,0	0,0	0,0	0,0	0,0	2,2							
Ampicillin	46	11	23,9							0,0	4,3	50,0	21,7	0,0	2,2	2,2	19,6					
Colistin (1)	46													97,8	2,2	0,0						
Sulfamethoxazole	46	10	21,7											39,1	26,1	13,0	0,0	0,0	0,0	0,0	0,0	21,7
Trimethoprim	46	7	15,2							76,1	6,5	2,2	0,0	0,0	0,0	0,0	15,2					
Tetracycline	46	13	28,3								47,8	19,6	4,3	0,0	0,0	0,0	4,3	23,9				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.8 Verotoxin-forming *E. coli* (VTEC) from animals and food, obtained as part of the zoonosis monitoring (2009)

Tab. 20.239: Resistance rates in verotoxin-forming *E. coli* from animals and food (2009)

	Bulk tank milk	Veal calves	Pork	Veal
Tested isolates	7	45	10	19
Susceptible	100	48,9	80,0	47,4
Resistant	0	51,1	20,0	52,6
Multiresistant (1)	0	33,3	20,0	52,7
Gentamicin	0	4,4	0	5,3
Kanamycin	0	15,6	0	21,1
Streptomycin	0	28,9	20,0	36,8
Chloramphenicol	0	13,3	0	5,3
Florfenicol	0	4,4	0	5,3
Cefotaxime	0	0	0	0
Ceftazidime	0	0	0	0
Nalidixic acid	0	2,2	0	0
Ciprofloxacin	0	6,7	0	0
Ampicillin	0	26,7	20,0	26,3
Sulfamethoxazol	0	35,6	20,0	52,6
Trimethoprim	0	17,8	20,0	26,3
Tetracycline	0	40	20,0	52,6

(1) Resistance to more than one class of antimicrobials

20.9 Distribution of MIC values in verotoxin-forming *E. coli* (VTEC), obtained as part of the zoonosis monitoring (2009)

20.9.1 Isolates from animals

Tab. 20.240: VTEC from bulk tank milk (2009)

				Distribution (%) of MICs (µg/ml) (3)																		
Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	7	0	0,0						42,9	42,9	14,3	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	7	0	0,0									0,0	71,4	28,6	0,0	0,0	0,0	0,0	0,0			
Chloramphenicol	7	0	0,0									0,0	42,9	57,1	0,0	0,0	0,0	0,0				
Florfenicol	7	0	0,0									0,0	42,9	57,1	0,0	0,0	0,0	0,0				
Cefotaxime	7	0	0,0				85,7	14,3	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	7	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	7	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	7	0	0,0	0,0	85,7	14,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	7	0	0,0							0,0	0,0	42,9	57,1	0,0	0,0	0,0	0,0					
Colistin (1)	7													100,0	0,0	0,0						
Sulfamethoxazole	7	0	0,0											71,4	28,6	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim	7	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0					
Tetracycline	7	0	0,0								57,1	42,9	0,0	0,0	0,0	0,0	0,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.241: VTEC from veal calves (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	45	2	4,4						51,1	35,6	8,9	0,0	0,0	4,4	0,0	0,0	0,0					
Kanamycin	45	7	15,6										84,4	0,0	0,0	0,0	0,0	0,0	15,6			
Streptomycin	45	13	28,9									2,2	46,7	17,8	4,4	2,2	4,4	0,0	22,2			
Chloramphenicol	45	6	13,3									0,0	46,7	37,8	2,2	0,0	0,0	13,3				
Florfenicol	45	2	4,4									2,2	46,7	46,7	0,0	0,0	0,0	4,4				
Cefotaxime	43	0	0,0				88,4	9,3	2,3	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	45	0	0,0						97,8	2,2	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	45	1	2,2										97,8	0,0	0,0	2,2	0,0	0,0				
Ciprofloxacin	44	3	6,8	9,1	75,0	9,1	4,5	2,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	45	12	26,7							0,0	4,4	40,0	28,9	0,0	0,0	0,0	26,7					
Colistin (1)	45													100,0	0,0	0,0						
Sulfamethoxazole	45	16	35,6											46,7	13,3	4,4	0,0	0,0	0,0	0,0	0,0	35,6
Trimethoprim	45	8	17,8							75,6	6,7	0,0	0,0	0,0	0,0	0,0	17,8					
Tetracycline	45	18	40,0								35,6	22,2	2,2	0,0	0,0	6,7	17,8	15,6				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.9.2 Isolates from food

Tab. 20.242: VTEC from veal (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	19	1	5,3						36,8	57,9	0,0	0,0	0,0	0,0	5,3	0,0	0,0					
Kanamycin	19	4	21,1										78,9	0,0	0,0	0,0	0,0	0,0	21,1			
Streptomycin	19	7	36,8									0,0	36,8	10,5	15,8	5,3	10,5	0,0	21,1			
Chloramphenicol	19	1	5,3									0,0	21,1	68,4	5,3	0,0	0,0	5,3				
Florfenicol	19	1	5,3									0,0	42,1	47,4	5,3	0,0	0,0	5,3				
Cefotaxime	19	0	0,0				84,2	15,8	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	19	0	0,0						100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	19	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	19	0	0,0	5,3	57,9	36,8	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	19	5	26,3							0,0	0,0	36,8	36,8	0,0	0,0	0,0	26,3					
Colistin (1)	19													100,0	0,0	0,0						
Sulfamethoxazole	19	10	52,6											26,3	15,8	5,3	0,0	0,0	0,0	0,0	0,0	52,6
Trimethoprim	19	5	26,3							73,7	0,0	0,0	0,0	0,0	0,0	0,0	26,3					
Tetracycline	19	10	52,6								15,8	31,6	0,0	0,0	0,0	0,0	31,6	21,1				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.243: VTEC from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (2)	Distribution (%) of MICs (µg/ml) (3)																		
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024	2048
Gentamicin	10	0	0,0						20,0	70,0	10,0	0,0	0,0	0,0	0,0	0,0	0,0					
Kanamycin	10	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0	0,0			
Streptomycin	10	2	20,0									0,0	30,0	50,0	0,0	0,0	0,0	0,0	20,0			
Chloramphenicol	10	0	0,0									0,0	40,0	60,0	0,0	0,0	0,0	0,0				
Florfenicol	10	0	0,0									0,0	50,0	50,0	0,0	0,0	0,0	0,0				
Cefotaxime	10	0	0,0				80,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0								
Ceftazidime	10	0	0,0						90,0	10,0	0,0	0,0	0,0	0,0	0,0	0,0						
Nalidixic acid	10	0	0,0										100,0	0,0	0,0	0,0	0,0	0,0				
Ciprofloxacin	10	0	0,0	10,0	50,0	40,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0							
Ampicillin	10	2	20,0							0,0	10,0	40,0	30,0	0,0	0,0	0,0	20,0					
Colistin (1)	10													100,0	0,0	0,0						
Sulfamethoxazole	10	2	20,0											40,0	20,0	20,0	0,0	0,0	0,0	0,0	0,0	20,0
Trimethoprim	10	2	20,0							70,0	10,0	0,0	0,0	0,0	0,0	0,0	20,0					
Tetracycline	10	2	20,0								40,0	40,0	0,0	0,0	0,0	0,0	20,0	0,0				

(1) For colistin no evaluation was performed as the lowest tested concentration was above the epidemiological cut-off value.
(2) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(3) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.10 Methicillin-resistant *Staphylococcus aureus* (MRSA), obtained as part of the zoonosis monitoring (2009)

20.10.1 Resistance rates of MRSA isolates by category of origin

Tab. 20.244: Resistance rates in MRSA from all origin groups (2008–2009)

Antimicrobial tested	Animal		Food		Total	
	Number	%	Number	%	Number	%
Tested isolates	133		813		946	
Gentamicin	55	41,4	203	25,0	258	27,3
Kanamycin	71	53,4	343	42,2	414	43,8
Chloramphenicol	6	4,5	38	4,7	44	4,7
Ciprofloxacin	8	6,0	185	22,8	193	20,4
Sulfamethoxazol/Trimethoprim	52	39,1	276	33,9	328	34,7
Vancomycin	0	0	1	0,1	1	0,1
Clindamycin	98	73,7	628	77,2	726	76,7
Erythromycin	87	65,4	586	72,1	673	71,1
Linezolid	2	1,5	10	1,2	12	1,3
Oxacillin + 2% NaCl	133	100,0	808	99,4	941	99,5
Mupirocin	0	0	0	0	0	0
Quinupristin/Dalfopristin	45	33,8	437	53,8	482	51,0
Tetracycline	133	100,0	793	97,5	926	97,9

Tab. 20.245: Resistance rates by *spa* types of MRSA from all origin groups (2008–2009)

Antimicrobial tested	Animals		Food				Total			
	CC398		CC398		Non-CC398		CC398		Non-CC398	
	Num-ber	%	Number	%	Number	%	Number	%	Number	%
Tested isolates	133		708		102		841		102	
Gentamicin	55	41,4	197	27,8	6	5,9	252	30,0	6	5,9
Kanamycin	71	53,4	306	43,2	36	35,3	377	44,8	36	35,3
Chloramphenicol	6	4,5	29	4,1	9	8,8	35	4,2	9	8,8
Ciprofloxacin	8	6,0	92	13,0	92	90,2	100	11,9	92	90,2
Sulfamethoxazol/ Trimethoprim	52	39,1	237	33,5	39	38,2	289	34,4	39	38,2
Vancomycin	0	0	1	0,1	0	0	1	0,1	0	0
Clindamycin	98	73,7	544	76,8	82	80,4	642	76,3	82	80,4
Erythromycin	87	65,4	498	70,3	86	84,3	585	69,6	86	84,3
Linezolid	2	1,5	5	0,7	5	4,9	7	0,8	5	4,9
Oxacillin + 2% NaCl	133	100	704	99,4	102	100	837	99,5	102	100
Mupirocin	0	0	0	0	0	0	0	0	0	0
Quinupristin/Dalfopristin	45	33,8	369	52,1	66	64,7	414	49,2	66	64,7
Tetracycline	133	100	707	99,9	83	81,4	840	99,9	83	81,4

20.10.2 Isolates from animals

Tab. 20.246: Resistance rates of MRSA isolates from animals of the zoonosis monitoring 2009

Antimicrobial tested	Laying hens	Broilers	Dairy cattle	Veal calves
Tested isolates	3	1	14	115
Gentamicin	33,3	0	0	47,0
Kanamycin	66,7	0	21,4	57,4
Chloramphenicol	0	100	0	4,3
Ciprofloxacin	33,3	0	0	6,1
Sulfamethoxazol/Trimethoprim	66,7	0	0	43,5
Vancomycin	0	0	0	0
Clindamycin	66,7	100	57,1	75,7
Erythromycin	33,3	100	57,1	67,0
Linezolid	0	0	0	1,7
Oxacillin + 2% NaCl	100	100	100	100
Mupirocin	0	0	0	0
Quinupristin/Dalfopristin	33,3	100	35,7	33,0
Tetracycline	100	100	0	100

Tab. 20.247: Resistance rates of MRSA isolates by *spa* types from animals of the zoonosis monitoring 2009

Antimicrobial tested	Laying hens			Broilers	Dairy cattle			Veal calves		
	t011	t034	other CC398	t034	t011	t034	other CC398	t011	t034	other CC398
Tested isolates	1	1	1	1	8	5	1	84	27	4
Gentamicin	100	0,0	0,0	0,0	0,0	0,0	0,0	60,7	0,0	75,0
Kanamycin	100	100	0,0	0,0	12,5	40,0	0,0	63,1	37,0	75,0
Chloramphenicol	0,0	0,0	0,0	100	0,0	0,0	0,0	4,8	3,7	0,0
Ciprofloxacin	0,0	100	0,0	0,0	0,0	0,0	0,0	3,6	14,8	0,0
Sulfamethoxazol/Trimethoprim	100	0,0	100	0,0	0,0	0,0	0,0	45,2	29,6	100
Vancomycin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Clindamycin	100	100	0,0	100	37,5	100	0,0	67,9	96,3	100
Erythromycin	100	0,0	0,0	100	37,5	100	0,0	63,1	74,1	100
Linezolid	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,4	0,0	0,0
Oxacillin + 2% NaCl	100	100	100	100	100	100	100	100	100	100
Mupirocin	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Quinupristin/Dalfopristin	0,0	100	0,0	100	12,5	80,0	0,0	21,4	66,7	50,0
Tetracycline	100	100	100	100	0,0	0,0	0,0	100	100	100

20.10.3 Isolates from food

Tab. 20.248: Resistance by *spa* types from food of the zoonosis monitoring 2009

Antimicrobial tested	Chicken meat		Turkey carcass		Turkey meat		Veal		Pork	
	CC398	Non-CC398	CC398	Non-CC398	CC398	Non-CC398	CC398	Non-CC398	CC398	Non-CC398
Tested isolates	120	38	179	15	206	32	56	2	147	15
Gentamicin	14,2	5,3	36,3	6,7	29,1	3,1	32,1	0	25,2	13,3
Kanamycin	37,5	28,9	50,3	26,7	46,6	40,6	41,1	0	35,4	53,3
Chloramphenicol	4,2	21,1	1,1	6,7	3,4	0	7,1	0	7,5	0
Ciprofloxacin	15,0	89,5	15,1	100	16,5	96,9	5,4	100	6,8	66,7
Sulfamethoxazol/ Trimethoprim	36,7	63,2	26,3	20	36,4	15,6	44,6	100	31,3	33,3
Vancomycin	0	0	0	0	0,5	0	0	0	0	0
Clindamycin	93,3	81,6	68,7	73,3	86,4	93,8	62,5	100	65,3	53,3
Erythromycin	89,2	84,2	60,3	73,3	79,6	93,8	60,7	100	57,8	73,3
Linezolid	1,7	5,3	1,1	6,7	0	3,1	0	0	0,7	6,7
Oxacillin + 2% NaCl	100	100	99,4	100	99,0	100	100	100	99,3	100
Mupirocin	0	0	0	0	0	0	0	0	0	0
Quinupristin/ Dalfopristin	65,8	60,5	55,3	73,3	60,7	78,1	32,1	50,0	32,7	40,0
Tetracycline	99,2	78,9	100	80	100	93,8	100	100	100	60,0

Tab. 20.249: Resistance by *spa* types from poultry meat of the zoonosis monitoring 2009

Antimicrobial tested	Chicken meat				Turkey carcass				Turkey meat			
	t011	t034	other CC398	Non-CC398	t011	t034	other CC398	Non-CC398	t011	t034	other CC398	Non-CC398
Tested isolates	60	48	12	38	112	56	11	15	113	85	8	32
Gentamicin	25,0	2,1	8,3	5,3	53,6	3,6	27,3	6,7	49,6	3,5	12,5	3,1
Kanamycin	55,0	20,8	16,7	28,9	66,1	16,1	63,6	26,7	57,5	34,1	25,0	40,6
Chloramphenicol	5,0	2,1	8,3	21,1	0,9	1,8	0	6,7	3,5	3,5	0	0
Ciprofloxacin	15,0	12,5	25,0	89,5	13,4	14,3	36,4	100	14,2	20,0	12,5	96,9
Sulfamethoxa-zol/Trimethoprim	45,0	27,1	33,3	63,2	27,7	21,4	36,4	20,0	36,3	38,8	12,5	15,6
Vancomycin	0	0	0	0	0	0	0	0	0,9	0	0	0
Clindamycin	91,7	95,8	91,7	81,6	52,7	96,4	90,9	73,3	77,0	100	75,0	93,8
Erythromycin	86,7	93,8	83,3	84,2	39,3	96,4	90,9	73,3	65,5	100	62,5	93,8
Linezolid	1,7	0	8,3	5,3	0	1,8	9,1	6,7	0	0	0	3,1
Oxacillin + 2% NaCl	100	100	100	100	99,1	100	100	100	99,1	98,8	100	100
Mupirocin	0	0	0	0	0	0	0	0	0	0	0	0
Quinupristin/ Dalfopristin	60,0	75,0	58,3	60,5	34,8	94,6	63,6	73,3	34,5	96,5	50	78,1
Tetracycline	25,0	2,1	8,3	5,3	100	100	100	80,0	100	100	100	93,8

Tab. 20.250: Resistance by *spa* types from veal and pork of the zoonosis monitoring 2009

Antimicrobial tested	Veal				Pork			
	t011	t034	other CC398	Non-CC398	t011	t034	other CC398	Non-CC398
Tested isolates	40	14	2	2	98	33	16	15
Gentamicin	42,5	0	50,0	0	34,7	0	18,8	13,3
Kanamycin	50	14,3	50,0	0	40,8	12,1	50	53,3
Chloramphenicol	7,5	7,1	0	0	7,1	3,0	18,8	0
Ciprofloxacin	5,0	0	50,0	100	4,1	6,1	25,0	66,7
Sulfamethoxazol/ Trimethoprim	45,0	42,9	50,0	100	35,7	12,1	43,8	33,3
Vancomycin	0	0	0	0	0	0	0	0
Clindamycin	55,0	78,6	100	100	55,1	93,9	68,8	53,3
Erythromycin	55,0	71,4	100	100	43,9	93,9	68,8	73,3
Linezolid	0	0	0	0	1,0	0	0	6,7
Oxacillin + 2% NaCl	100	100	100	100	99,0	100	100	100
Mupirocin	0	0	0	0	0	0	0	0
Quinupristin/ Dalfopristin	25,0	50,0	50,0	50,0	16,3	84,8	25,0	40,0
Tetracycline	100	100	100	100	100	100	100	60,0

20.10.4 Distribution of MIC values in MRSA isolates, obtained as part of the zoonosis monitoring (2009)

20.10.4.1 Isolates from animals

Tab. 20.251: MRSA from laying hens (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	Distribution (%) of MICs (µg/ml) (2) 0,008	0,015	0,03125	0,0625	0,125	0,25	0.5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	3	1	33,3							66,7	0,0	0,0	0,0	0,0	0,0	0,0	33,3				
Kanamycin	3	2	66,7											33,3	0,0	33,3	0,0	0,0	33,3		
Chloramphenicol	3	0	0,0									0,0	0,0	33,3	66,7	0,0	0,0	0,0	0,0		
Ciprofloxacin	3	1	33,3							66,7	0,0	0,0	0,0	33,3	0,0	0,0	0,0				
Sulfamethoxazol/Trimethoprim	3	2	66,7						0,0	33,3	66,7	0,0	0,0	0,0	0,0						
Vancomycin	3	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	3	2	66,7						33,3	0,0	0,0	0,0	0,0	0,0	33,3	0,0	33,3				
Erythromycin	3	1	33,3					0,0	33,3	0,0	33,3	0,0	0,0	0,0	0,0	33,3					
Linezolid	3	0	0,0								0,0	33,3	66,7	0,0	0,0						
Oxacillin + 2% NaCl	3	3	100,0							0,0	0,0	0,0	0,0	0,0	100,0						
Mupirocin	3	0	0,0								100,0	0,0	0,0	0,0	0,0						
Quinupristin/Dalfopristin	3	1	33,3							33,3	33,3	0,0	33,3	0,0							
Tetracycline	3	3	100,0								0,0	0,0	0,0	0,0	0,0	0,0	33,3	66,7			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.252: MRSA from broilers (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	Distribution (%) of MICs (µg/ml) (2) 0,008	0,015	0,03125	0,0625	0,125	0,25	0.5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0				
Kanamycin	1	0	0,0											100,0	0,0	0,0	0,0	0,0			
Chloramphenicol	1	1	100,0									0,0	0,0	0,0	0,0	0,0	0,0	100,0	0,0		
Ciprofloxacin	1	0	0,0							100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0				
Sulfamethoxazol/Trimethoprim	1	0	0,0						0,0	100,0	0,0	0,0	0,0	0,0	0,0						
Vancomycin	1	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	1	1	100,0						0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0				
Erythromycin	1	1	100,0					0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0						
Linezolid	1	0	0,0								0,0	0,0	100,0	0,0	0,0						
Oxacillin + 2% NaCl	1	1	100,0							0,0	0,0	0,0	0,0	0,0	100,0						
Mupirocin	1	0	0,0								100,0	0,0	0,0	0,0	0,0						
Quinupristin/Dalfopristin	1	1	100,0							0,0	0,0	0,0	100,0	0,0	0,0						
Tetracycline	1	1	100,0								0,0	0,0	0,0	0,0	0,0	0,0	0,0	100,0			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.253: MRSA from dairy cattle (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	Distribution (%) of MICs (µg/ml) (2)																	
				0,008	0,015	0,03125	0,0625	0,125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	14	0	0,0							78,6	14,3	7,1	0,0	0,0	0,0	0,0	0,0				
Kanamycin	14	3	21,4											78,6	7,1	7,1	0,0	7,1			
Chloramphenicol	14	0	0,0									0,0	0,0	35,7	64,3	0,0	0,0	0,0	0,0		
Ciprofloxacin	14	0	0,0							85,7	14,3	0,0	0,0	0,0	0,0	0,0	0,0				
Sulfamethoxazol/Trimethoprim	14	0	0,0						71,4	28,6	0,0	0,0	0,0	0,0	0,0						
Vancomycin	14	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	14	8	57,1						42,9	0,0	0,0	0,0	0,0	0,0	14,3	0,0	42,9				
Erythromycin	14	8	57,1					0,0	14,3	21,4	7,1	0,0	0,0	0,0	0,0	57,1					
Linezolid	14	0	0,0								7,1	21,4	71,4	0,0	0,0						
Oxacillin + 2% NaCl	14	14	100,0							0,0	0,0	0,0	7,1	14,3	78,6						
Mupirocin	14	0	0,0								100,0	0,0	0,0	0,0	0,0						
Quinupristin/Dalfopristin	14	5	35,7							42,9	21,4	21,4	7,1	0,0	7,1						
Tetracycline	14	14	100,0								0,0	0,0	0,0	0,0	0,0	0,0	21,4	78,6			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.
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Tab. 20.254: MRSA from veal calves (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	Distribution (%) of MICs (µg/ml) (2)																	
				0,008	0,015	0,03125	0,0625	0,125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	115	54	47,0							43,5	8,7	0,9	2,6	5,2	4,3	12,2	14,8	7,8			
Kanamycin	115	66	57,4											42,6	13,9	5,2	3,5	3,5	31,3		
Chloramphenicol	115	5	4,3									0,0	0,0	20,0	75,7	0,9	1,7	1,7	0,0		
Ciprofloxacin	115	7	6,1							87,8	6,1	1,7	0,0	0,0	3,5	0,9	0,0				
Sulfamethoxazol/Trimethoprim	115	50	43,5						23,5	33,0	30,4	11,3	1,7	0,0	0,0						
Vancomycin	115	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	115	87	75,7						24,3	7,0	0,0	0,9	0,0	0,0	1,7	1,7	64,3				
Erythromycin	115	77	67,0					0,0	2,6	16,5	13,9	0,9	0,0	0,0	0,0	66,1					
Linezolid	115	2	1,7								5,2	39,1	53,9	1,7	0,0						
Oxacillin + 2% NaCl	115	115	100,0							0,0	0,0	0,0	0,9	11,3	87,8						
Mupirocin	115	0	0,0								100,0	0,0	0,0	0,0	0,0						
Quinupristin/Dalfopristin	115	38	33,0							28,7	38,3	14,8	5,2	11,3	1,7						
Tetracycline	115	115	100,0								0,0	0,0	0,0	0,0	0,9	0,0	16,5	82,6			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.10.4.2 Isolates from food

Tab. 20.255: MRSA from chicken meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	0,008	0,015	0,03125	0,0625	0,125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
				Distribution (%) of MICs (µg/ml) (2)																	
Gentamicin	158	19	12,0							67,1	15,2	5,7	1,3	1,3	1,9	2,5	1,3	3,8			
Kanamycin	158	56	35,4											64,6	13,3	5,1	3,8	2,5	10,8		
Chloramphenicol	158	13	8,2									0,0	0,0	12,0	79,7	7,0	0,6	0,6	0,0		
Ciprofloxacin	158	52	32,9							55,1	12,0	7,6	0,6	1,3	19,6	3,2	0,6				
Sulfamethoxazol/Trimethoprim	158	68	43,0						34,2	22,8	17,7	14,6	8,2	1,9	0,6						
Vancomycin	158	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	158	143	90,5						9,5	1,9	1,3	0,0	0,0	0,0	6,3	1,9	79,1				
Erythromycin	158	139	88,0					0,0	0,6	9,5	1,9	0,6	0,0	0,0	0,0	87,3					
Linezolid	158	4	2,5								1,3	33,5	62,7	1,9	0,0	0,6					
Oxacillin + 2% NaCl	158	158	100,0							0,0	0,0	0,0	0,0	13,9	86,1						
Mupirocin	158	1	0,6								99,4	0,6	0,0	0,0	0,0						
Quinupristin/Dalfopristin	158	102	64,6							14,6	20,9	31,6	17,1	11,4	4,4						
Tetracycline	158	149	94,3								5,7	0,0	0,0	0,0	0,0	3,2	32,3	58,9			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.256: MRSA from turkey carcasses (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	0,008	0,015	0,03125	0,0625	0,125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
				Distribution (%) of MICs (µg/ml) (2)																	
Gentamicin	194	66	34,0							48,5	14,4	3,1	0,0	1,0	2,1	9,8	12,4	8,8			
Kanamycin	194	94	48,5											51,5	9,8	2,1	0,5	5,7	30,4		
Chloramphenicol	194	3	1,5									0,0	1,0	30,4	67,0	0,5	1,0	0,0	0,0		
Ciprofloxacin	194	42	21,6							68,6	9,8	9,8	0,5	1,5	6,7	1,5	1,0	0,5			
Sulfamethoxazol/Trimethoprim	194	50	25,8						42,3	32,0	19,1	4,6	1,0	0,5	0,0	0,5					
Vancomycin	194	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	194	134	69,1						30,9	3,6	3,6	0,5	0,0	0,0	5,7	6,2	49,5				
Erythromycin	194	119	61,3					0,0	1,0	27,8	9,8	0,0	0,0	0,5	0,0	60,8					
Linezolid	194	3	1,5								2,6	37,1	58,8	1,5	0,0						
Oxacillin + 2% NaCl	194	193	99,5							0,5	0,0	0,0	2,6	13,9	83,0						
Mupirocin	194	2	1,0								99,0	1,0	0,0	0,0	0,0						
Quinupristin/Dalfopristin	194	110	56,7							32,5	10,8	22,7	20,1	8,8	5,2						
Tetracycline	194	191	98,5								1,5	0,0	0,0	0,0	0,0	1,5	26,3	70,6			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.257: MRSA from turkey meat (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	Distribution (%) of MICs (µg/ml) (2)																	
				0,008	0,015	0,03125	0,0625	0,125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	240	61	25,4							57,9	15,4	1,3	0,4	0,4	3,3	8,8	7,5	5,0			
Kanamycin	240	109	45,4											54,6	11,7	2,1	1,7	5,4	24,6		
Chloramphenicol	240	7	2,9									0,0	0,0	27,1	70,0	2,5	0,0	0,4	0,0		
Ciprofloxacin	240	66	27,5							56,3	16,3	9,2	0,8	2,5	12,5	1,3	1,3				
Sulfamethoxazol/Trimethoprim	240	80	33,3						35,0	31,7	25,8	4,6	2,1	0,4	0,0	0,4					
Vancomycin	240	1	0,4									99,6	0,4	0,0	0,0	0,0					
Clindamycin	240	209	87,1						12,9	2,9	2,5	0,0	0,0	0,4	6,3	3,3	71,7				
Erythromycin	240	195	81,3					0,0	1,7	9,6	7,5	0,0	0,0	0,0	0,0	81,3					
Linezolid	240	1	0,4								5,8	45,4	48,3	0,4	0,0						
Oxacillin + 2% NaCl	240	237	98,8							1,3	0,0	0,0	2,1	11,3	85,4						
Mupirocin	240	1	0,4								99,6	0,4	0,0	0,0	0,0						
Quinupristin/Dalfopristin	240	151	62,9							13,8	23,3	21,7	17,9	17,5	5,8						
Tetracycline	240	238	99,2								0,8	0,0	0,0	0,0	0,0	0,8	19,6	78,8			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range tance.

Tab. 20.258: MRSA from veal (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	Distribution (%) of MICs (µg/ml) (2)																	
				0,008	0,015	0,03125	0,0625	0,125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	58	18	31,0							51,7	17,2	0,0	1,7	0,0	0,0	8,6	10,3	10,3			
Kanamycin	58	23	39,7											60,3	10,3	0,0	0,0	3,4	25,9		
Chloramphenicol	58	4	6,9									1,7	0,0	29,3	62,1	5,2	0,0	1,7	0,0		
Ciprofloxacin	58	5	8,6							87,9	3,4	1,7	0,0	1,7	3,4	1,7	0,0				
Sulfamethoxazol/Trimethoprim	58	27	46,6						29,3	24,1	29,3	10,3	5,2	0,0	0,0	1,7					
Vancomycin	58	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	58	37	63,8						36,2	1,7	0,0	0,0	0,0	0,0	3,4	3,4	55,2				
Erythromycin	58	36	62,1					0,0	6,9	19,0	12,1	0,0	0,0	0,0	0,0	62,1					
Linezolid	58	0	0,0								5,2	36,2	58,6	0,0	0,0						
Oxacillin + 2% NaCl	58	58	100,0							0,0	0,0	0,0	1,7	15,5	82,8						
Mupirocin	58	0	0,0								100,0	0,0	0,0	0,0	0,0						
Quinupristin/Dalfopristin	58	19	32,8							43,1	24,1	20,7	1,7	8,6	1,7						
Tetracycline	58	58	100,0								0,0	0,0	0,0	0,0	0,0	1,7	8,6	89,7			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.259: MRSA from pork (2009)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	0,008	0,015	0,03125	0,0625	0,125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	1024
				Distribution (%) of MICs (µg/ml) (2)																	
Gentamicin	163	39	23,9							57,7	14,1	4,3	0,6	3,7	3,1	3,7	6,7	6,1			
Kanamycin	163	61	37,4											62,6	6,7	5,5	1,2	3,1	20,9		
Chloramphenicol	163	11	6,7									0,0	0,0	35,0	58,3	5,5	0,6	0,6	0,0		
Ciprofloxacin	163	20	12,3							81,0	6,7	4,3	0,6	0,6	4,3	0,6	0,6	1,2			
Sulfamethoxazol/Trimethoprim	163	51	31,3						49,7	19,0	20,2	8,0	2,5	0,0	0,0	0,6					
Vancomycin	163	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	163	105	64,4						35,6	5,5	1,8	0,0	0,0	0,0	2,5	2,5	52,1				
Erythromycin	163	97	59,5					0,0	6,1	20,2	14,1	0,0	0,0	0,0	0,0	59,5					
Linezolid	163	3	1,8								1,2	46,0	50,9	1,8	0,0						
Oxacillin + 2% NaCl	163	162	99,4							0,0	0,6	0,0	3,1	17,8	78,5						
Mupirocin	163	1	0,6								99,4	0,6	0,0	0,0	0,0						
Quinupristin/Dalfopristin	163	55	33,7							36,8	29,4	14,1	11,0	8,0	0,6						
Tetracycline	163	157	96,3								3,7	0,0	0,0	0,0	0,0	1,8	21,5	73,0			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

20.11 Methicillin-resistant *Staphylococcus aureus* (MRSA) from other studies (2008)

20.11.1 Resistance rates by clonal complexes and spa types

Tab. 20.260: Resistance rates of isolates from fattening and breeding pig herds by clonal complexes

Antimicrobial tested	Breeding pig herds			Fattening pig herds
	CC398	Non-CC398	total	CC398
Tested isolates	78	6	84	152
Gentamicin	24,4	33,3	25,0	21,7
Kanamycin	41,0	50,0	41,7	49,3
Chloramphenicol	5,1	0,0	4,8	6,6
Ciprofloxacin	11,5	16,7	11,9	5,3
Sulfamethoxazol/Trimethoprim	26,9	16,7	26,2	40,1
Vancomycin	0,0	0,0	0,0	0,0
Clindamycin	56,4	100,0	59,5	68,4
Erythromycin	44,9	50,0	45,2	61,2
Linezolid	0,0	0,0	0,0	0,0
Oxacillin + 2% NaCl	80,8	66,7	79,8	95,4
Mupirocin	2,6	16,7	3,6	0,0
Quinupristin/Dalfopristin	19,2	0,0	17,9	31,6
Tetracycline	100,0	83,3	98,8	100,0

Tab. 20.261: Resistance rates of isolates from fattening and breeding pig herds by *spa* types

Antimicrobial tested	Herds of breeding pigs				Herds of fattening pigs		
	t011	t034	andere CC398	Non-CC398	t011	t034	andere CC398
Tested isolates	56	12	10	6	101	35	16
Gentamicin	30,4	8,3	10,0	33,3	30,7	2,9	6,3
Kanamycin	46,4	41,7	10,0	50,0	53,5	45,7	31,3
Chloramphenicol	3,6	0,0	20,0	0,0	7,9	2,9	6,3
Ciprofloxacin	10,7	0,0	30,0	16,7	3,0	11,4	6,3
Sulfamethoxazol/ Trimethoprim	28,6	25,0	20,0	16,7	44,6	31,4	31,3
Vancomycin	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Clindamycin	51,8	83,3	50,0	100,0	63,4	74,3	87,5
Erythromycin	42,9	50,0	50,0	50,0	54,5	74,3	75,0
Linezolid	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Oxacillin + 2% NaCl	76,8	91,7	90,0	66,7	95,0	97,1	93,8
Mupirocin	3,6	0,0	0,0	16,7	0,0	0,0	0,0
Quinupristin/ Dalfopristin	12,5	41,7	30,0	0,0	19,8	54,3	56,3
Tetracycline	100,0	100,0	100,0	83,3	100,0	100,0	100,0

20.11.2 Distribution of MIC values in MRSA isolates from other studies (2008)

Tab. 20.262: MRSA from German breeding pig herds (2008)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	Distribution (%) of MICs (µg/ml) (2)																	
				0,008	0,015	0,03125	0,0625	0,125	0,25	0,5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	84	21	25,0							34,5	26,2	14,3	2,4	3,6	0,0	3,6	3,6	11,9			
Kanamycin	84	35	41,7											58,3	14,3	2,4	0,0	3,6	21,4		
Chloramphenicol	84	4	4,8									1,2	2,4	51,2	40,5	0,0	3,6	1,2	0,0		
Ciprofloxacin	84	10	11,9							77,4	10,7	2,4	2,4	6,0	0,0	0,0	0,0	1,2			
Sulfamethoxazol/Trimethoprim	84	22	26,2						58,3	15,5	16,7	6,0	3,6	0,0	0,0						
Vancomycin	84	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	84	50	59,5						40,5	6,0	3,6	0,0	1,2	2,4	1,2	0,0	45,2				
Erythromycin	84	38	45,2					1,2	8,3	42,9	2,4	0,0	0,0	0,0	0,0	45,2					
Linezolid	84	0	0,0								6,0	58,3	35,7	0,0	0,0						
Oxacillin + 2% NaCl	84	67	79,8							3,6	6,0	10,7	4,8	13,1	61,9						
Mupirocin	84	3	3,6								96,4	3,6	0,0	0,0	0,0						
Quinupristin/Dalfopristin	84	15	17,9							47,6	34,5	9,5	6,0	2,4							
Tetracycline	84	83	98,8								1,2	0,0	0,0	0,0	0,0	3,6	56,0	39,3			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

Tab. 20.263: MRSA from farms of German fattening pig herds (2008)

Antimicrobial tested	Tested isolates (Number)	Microbiological resistant isolates (Number) (1)	Microbiological resistant isolates (in %) (1)	Distribution (%) of MICs (µg/ml) (2)																	
				0,008	0,015	0,03125	0,0625	0,125	0,25	0.5	1	2	4	8	16	32	64	128	256	512	1024
Gentamicin	152	33	21,7							37,5	31,6	9,2	2,6	2,0	2,0	3,9	2,6	8,6			
Kanamycin	152	75	49,3											50,7	15,1	9,9	6,6	2,0	15,8		
Chloramphenicol	152	10	6,6									0,0	1,3	38,2	53,9	2,6	2,6	1,3	0,0		
Ciprofloxacin	152	8	5,3							88,2	6,6	1,3	2,0	2,0	0,0	0,0	0,0				
Sulfamethoxazol/Trimethoprim	152	62	40,8						43,4	15,8	26,3	11,8	2,0	0,7	0,0						
Vancomycin	152	0	0,0									100,0	0,0	0,0	0,0	0,0					
Clindamycin	152	104	68,4						31,6	3,9	0,7	0,0	0,7	0,7	2,6	59,2	0,7				
Erythromycin	152	93	61,2					0,0	2,6	29,6	6,6	0,0	0,0	0,0	0,0	61,2					
Linezolid	152	0	0,0								100,0	0,0	0,0	0,0	0,0						
Oxacillin + 2% NaCl	152	145	95,4							2,6	1,3	0,7	6,6	37,5	51,3						
Mupirocin	152	0	0,0								100,0	0,0	0,0	0,0	0,0						
Quinupristin/Dalfopristin	152	48	31,6							34,2	34,2	16,4	7,9	3,3	3,9						
Tetracycline	152	152	100,0								0,0	0,0	0,0	0,0	0,0	0,7	24,3	75,0			

(1) The vertical lines demark the epidemiological cut-off values, which are the basis for the evaluation of microbiological resistance.
(2) The white areas demark the ranges tested. Isolates resistant to the highest concentration are given in the next concentration level. Values for the lowest concentration include isolates with MICs below the tested range.

21 Glossary

DNA-Probe
A DNA-Probe is a small synthetic DNA fragment designed to bind to a specific target sequence.

Endemic
Prevalent in a population in a given time period.

Epidemiological cut-off (-value)
When testing the minimum inhibitory concentration, the epidemiological cut-off value is an interpretive criterion used for monitoring purposes to classify isolates as wildtype or non-wildtype (see below). In this report, non-wildtype isolates are addressed as resistant.

Gene cassette
Gene cassettes are discrete genetic elements. They may exist as free, circular, non-replicating DNA molecules when moving from one genetic site to another. They are normally found as linear sequences that constitute part of a larger DNA molecule, such as a plasmid or bacterial chromosome. Gene cassettes normally contain only a single gene and an additional short sequence, called a 59 base element that functions as a specific recombination site. Accordingly, the cassettes are small, normally in the order of 500–1000 bp. The genes carried on gene cassettes usually lack promoters and are expressed from a promoter on the integron.

Genomic island
Genomic islands are parts of the genome that used to be mobile and are now fixed. Some genomic islands can excise themselves spontaneously from the chromosome and can be transferred to other suitable recipients. They can encode many functions, for example antibiotic resistance as in *Salmonella* genomic island I.

Integron
An integron is a genetic element that possesses a site, *attI*, at which additional DNA, in the form of gene cassettes, can be integrated by site-specific recombination, and which encodes the enzyme integrase that mediates these site-specific recombination events.

Clinical breakpoint
MIC that will allow for successful treatment considering pharmacokinetics, pharmacodynamics and clinical aspects. Clinical breakpoints need to be defined specifically for the pathogen/tissue/animal species combination. They are defined by international bodies (e.g. CLSI or EUCAST).

Clone
A cell, group of cells, or organism that is descended from and genetically identical to a single common ancestor, such as a bacterial colony whose members arose from a single original cell.

Commensals
Bacteria colonizing the host without doing harm.

Microarray	Microarrays are molecular biological examination systems that can be used for the simultaneous analysis of several thousand probe sets (genes for example) in a biological sample.
Minimum inhibitory concentration (MIC)	The minimal concentration of a substance that inhibits bacterial growth.
Multiresistant	In this report, an isolate was considered multiresistant if it was resistant to more than one antimicrobial class.
Plasmid	Plasmids are extrachromosomal, often circular mobile genetic elements able to replicate independently from the chromosomal DNA. They encode antibiotic resistance and metabolic or virulence characteristics, and are often associated with horizontal gene transfer.
Polymerase chain reaction (PCR)	PCR is a method to amplify a few copies of DNA based on the enzyme DNA-polymerase. The method relies on thermal cycling, consisting of cycles of repeated heating and cooling for DNA melting and enzymatic replication of the DNA, resulting in amplification across several orders of magnitude.
Primers	Primers are short DNA sequences designed to match specific sites used as a starting point in PCR, for example.
Real time PCR, RT-PCR	RT-PCR is a PCR method that allows quantification of the amplified DNA sequence, commonly in real time.
Resistant	An isolate was considered resistant if its MIC was above the epidemiological cut-off value.
Susceptible, susceptibility	An isolate was considered susceptible if its MIC was equal to or lower than the epidemiological cut-off value. Without reference to a specific substance, it refers to isolates that were considered susceptible to all tested substances.
SGI 1	*Salmonella* genomic island is a 43-kb genomic region that contains many drug resistance genes along with two class 1 integrons. SGI1 has been found in *Salmonella enterica* serovars and their serologic variants, such as *S.* Agona, *S.* Paratyphi B, *S.* Newport, *S.* Albany and *S.* Meleagridis, suggesting horizontal gene transfer of this region. Common resistance genes found on SGI1 are bla_{PSE-1} for ampicillin, *floR* for chloramphenicol/florfenicol, *aadA2* for streptomycin/spectinomycin, *tet*[G] for tetracycline and *sul1* for resistance to sulfonamides.

Transposon	Transposons are mobile genetic elements able to change their position within the genome of a single cell. The mechanism of transposition can be either "copy and paste" or "cut and paste".
Wild-type population **(Definition by EUCAST)**	A micro-organism is defined as wild-type (WT) for a bacterial species by the absence of acquired and mutational resistance mechanisms to the drug in question. A micro-organism is categorized as wild-type (WT) for a species by applying the appropriate cut-off value in a defined phenotypic test system. This cut-off value will not be altered by changing circumstances. Wild-type micro-organisms may or may not respond clinically to antimicrobial treatment.
Zoonosis	Zoonosis means any disease and/or infection which are naturally transmissible directly or indirectly between animals and humans; (Dir 2003/99/EC).
Zoonotic agents	Zoonotic agent means any virus, bacterium, fungus, parasite or other biological entity which is likely to cause a zoonosis; (Dir 2003/99/EC).

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