MINISTRY OF
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Annual Report on Zoonoses in Denmark 2004





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Contents

Introduction

The Annual Report on Zoonoses presents a summary of the trends and sources of zoonotic infections in humans and animals, as well as the occurrence of zoonotic agents in food and feeding stuffs in Denmark in 2004. The report is based on data compiled according to the zoonoses directive 92/117/EEC, supplemented by data obtained from national surveillance and control programmes as well as data from relevant research projects provided by the institutions, which contributed to the preparation of this report. The report is also available at www.dfvf.dk.

The structure of this year's report is different compared to previous versions. The report now includes a general chapter describing the surveillance of zoonotic agents and outbreak investigations in Denmark. The chapter is complemented by tables in the Appendix providing an overview of current surveillance programmes, including sample schemes and references to the relevant legislation. The order in which data are reported has also been changed. Thus, for each zoonotic agent, the disease status in humans is reported first followed by the findings in animals, food and feeding stuffs (*Salmonella* only). The majority of tables is located in the Appendix, while figures are included in the appropriate chapters. Contributing institutions and their appropriate abbreviations are listed on the back page.

Profile of the year

The number of human *Salmonella* cases has steadily decreased since 1997 and continued to do so in 2004. A total of 1,538 *Salmonella* cases were reported. This represents a decrease of 11% compared to 2003 and a three-fold decrease since 1997. The decrease was attributed almost exclusively to a lower number of S. Enteritidis cases, while the number of cases caused by S. Typhimurium and other serotypes remained at the same level as in 2003. The decrease in the number of human S. Enteritidis infections is mainly explained by the continuous positive effect of the surveillance and control of *Salmonella* in the table-egg production. The Danish Zoonsis Centre estimates that the number of egg-associated cases was reduced from 5.0 cases per 100,000 inhabitants in 2003 to 1.9 cases per 100,000 in 2004. Cases related to domestically produced pork also decreased from 3.8 to 1.9 cases per 100,000. The number of broiler-associated cases has remained stable since 2002 at 0.7-0.8 per 100,000. Overall, 19% of all *Salmonella* cases were attributed to Danish produced food of animal origin, whereas 21% were associated with the consumption of imported meat and meat products. Thirty percent of *Salmonella* cases were estimated to be travel related (27%) or part of an outbreak with unknown source (3%). The remaining approximately 30% of cases could not be associated with any source.

In contrast to 2003, where the number of human *Campylobacter* cases decreased by almost 15%, the number of cases increased by 5% in 2004. While the human incidence increased slightly, the prevalence of *Campylobacter* continued to decrease in broiler flocks. In 2004, an average of 27% of Danish broiler flocks were found positive for *Campylobacter*. This is a significant reduction compared to the prevalence of *Campylobacter* in broilers prior to the implementation of a national intervention strategy aiming at reducing the number of *Campylobacter* in Danish broiler meat.

Outbreaks

Generally the number of reported outbreaks was lower in 2004 than in previous years. However, in 2004 Denmark experienced its first VTEC outbreaks. The largest of these was caused by VTEC O157 and involved 25 laboratory-confirmed cases from or near the Copenhagen area. The outbreak investigation included a case-control study and pointed at milk produced at a relatively small organic dairy. Extensive sampling of milk and equipment surfaces at the dairy revealed no positive samples, but the outbreak nonetheless ceased after thorough desinfecting and adjustment of procedures. The second outbreak occurred among visitors, primarily children, of a petting farm. At least five people were infected with various VTEC serotypes. The farm was temporarily closed, but reopened after improvement of the sanitation facilities (see page 6).

Surveillance

The *Salmonella* surveillance programmes in the poultry and pig production continued as described in previous issues of the Annual Report on Zoonoses in Denmark. A minor adjustment was implemented in the S. Dublin surveillance programme in cattle herds (see page 16) as well as in the BSE surveillance programme (see page 24). Overviews of the surveillance programmes are presented in the Appendix Tables A14-A17.

1. Surveillance and outbreak investigations

1.1 Surveillance of human disease

Described in this report, are the zoonotic enteric pathogens, which are notifiable through the laboratory surveillance system: *Salmonella, Campylobacter, Yersinia* and verocytotoxin-producing *E. coli,* individually notifiable zoonotic pathogens: *Chlamydia psittacci* (ornithosis), *Leptospira*, *Listeria, Mycobacterium*, BSE prions (var. Creutzfeldt-Jakob Disease), *Lyssavirus* (rabies), as well as non-notifiable zoonotic pathogens: *Brucella, Cryptosporidium*, *Echinococcus, Toxoplasma*, and *Trichinella*. An overview of the notifiable and not notifiable human diseases with reference to the relevant legislation is provided in Table 14.

In Denmark, the physicians report individually notifiable zoonotic diseases to Department of Epidemiology at the Statens Serum Institut (SSI). Positive cases diagnosed by a clinical microbiological laboratory are reported through the laboratory surveillance system to the Unit of Gastrointestinal Infections at SSI. Physicians send specimens from suspect cases to one of the 13 clinical microbiology laboratories depending on county of residence of the requesting physician. The laboratories must report positive results to the SSI within one week. Further, all *Salmonella* isolates are sent into the reference laboratory at SSI for further typing. The results are recorded in the Register of Enteric Pathogens (REP) maintained by SSI. Positive cases are recorded as episodes, i.e. each person-infectious agent combination is only registered once in a six-month period.

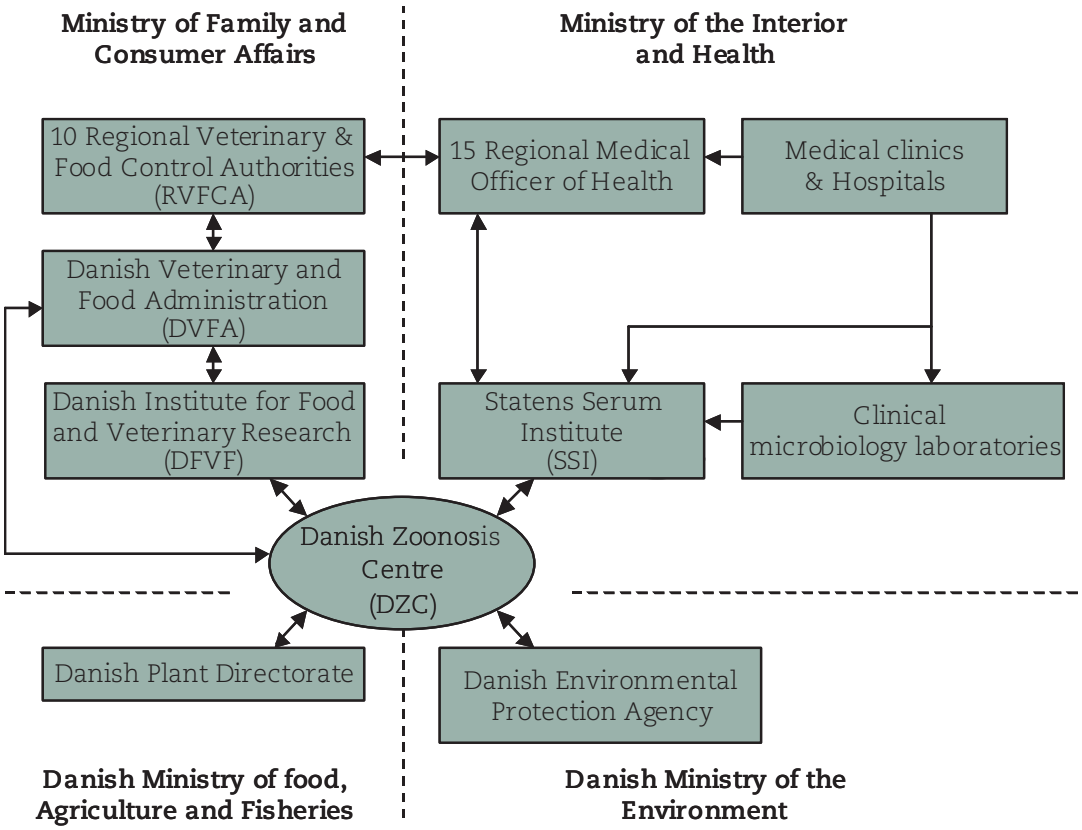

Figure 1. Overview of the monitoring and outbreak investigation network for reporting infectious pathogens in humans, animals and feedstuffs in Denmark. DZC is a part of DFVF, but activities are co-ordinated by a body of representatives from all four ministries.

1.2 Outbreaks of zoonotic gastrointestinal infections

In Denmark, there are three different systems for reporting food-borne zoonoses outbreaks (Figure 1):

I) Physicians are obligated to report all suspect food-borne infections prior to clinical confirmation. These early notifications are sent to the regional medical officer, as well as to the Department of Epidemiology at the SSI.

II) Clusters of cases identified through the laboratory surveillance system of gastrointestinal zoonotic infections are reported via the Unit of Gastrointestinal Infections at the SSI.

III) Individuals who experience food poisoning may report these incidents directly to the Regional Veterinary and Food Control Authorities (RVFCA), who investigate and report the outbreaks to the Danish Food and Veterinary Administration (DVFA).

Overlaps between these three systems may exist. A fourth system exists for water-borne outbreaks that are reported to and handled by the local municipalities.

At the end of 2004, the responsibility of tracking food- or waterborne outbreaks was divided between three ministries based on the outbreak source: Ministry for the Interior and Health, for infectious diseases, Ministry of Family and Consumer Affairs, for food and animal related diseases and the Ministry of Environment, for water related diseases. The Danish Zoonosis Centre (DZC) co-ordinates the close collaborations between the Danish Institute for Food and Veterinary Research (DFVF), SSI and DFVA. Representatives from these institutions meet regularly to discuss the surveillance results and compare the incidence in humans, with the occurrence of zoonotic agents in animals, food and feedstuffs (Figure 1). Local outbreaks are typically investigated by the RVFCA and the medical officer in collaboration.

Fewer outbreaks were reported in 2004 compared to 2003. General practitioners reported a total of 48 outbreaks to the SSI, equal to that for 2003 (Table 1). The RVFCA reported 29 outbreaks in 2004, but zoonotic agents caused only two of these and both

Table 1. Clinical based surveillance of suspected outbreaks of food-borne diseases reported to the SSI, 2004.

	General outbreaks		Outbreaks within the household	
Zoonotic pathogen	N	Suspected source	N	Suspected source
S. Enteritidis	2	Various food items	6	Shrimp, turkey, chicken, eggs
S. Typhimurium	4	Pizza, various or unknown food items	1	Chicken
Other zoonotic *Salmonella* spp.	1	Unknown	2	Unknown
Campylobacter	7	Chicken, various or unknown food items	9	Chicken, eggs, unpasteurized milk, ham
Yersinia	2	Unknown	1	Unknown
Toxin	1	Redfish	1	Various food items
Trichinella	0	-	1	Smoked pork sausages
Unknown	8	Pizza, shrimp, various or unknown food items	2	Chicken, fish, various food items
Total	25		23	

Source: SSI

Table 2. Outbreaks identified by laboratory-based surveillance of zoonotic diseases, 2004[a]

Type of outbreak	Pathogen	Confirmed cases	Suspected source
General outbreak	VTEC, O157:H-	25	Pasteurised milk
Regional outbreak	VTEC, several serotypes	5	Goats, petting farm
Regional outbreak	S . Typhimurium[b], DT12, fully susceptible PFGE 22, MLVA 52	24	Butcher shop
General outbreak	S . Typhimurium, DT NT, AST, PFGE 47, MLVA 59	34	Pork
General outbreak	S . Typhimurium, DT NT, ASSuT, PFGE 99, MLVA 5	10	Imported pork
General outbreak	S . Typhimurium, DT12, fully susceptible, PFGA 22, MLVA 56	25	?
General outbreak	S . Typhimurium, DT 120, fully susceptible, PFGE 6	18	Pork
General outbreak	S . Typhimurium, DT 104, AS	11	Danish pork

[a]Household outbreaks were not included.
[b]Where applicable, S. Typhimurium strains are listed with their phagetype, resistance profile, PFGE and MLVA type, which refers to the database system number from the reference lab that performed the typing tests.
Source: SSI

were also reported via the laboratory-based surveillance system. The laboratory system identified eight outbreaks, representing a total of 152 confirmed cases (Table 2). In 2003, 12 outbreaks and 115 confirmed cases were reported through the laboratory-based surveillance system. S. Typhimurium was the cause of all *Salmonella* outbreaks detected by the laboratory surveillance system. This may be partly the reflection of increased typing efforts. In 2004, S. Typhimurium isolates were routinely sub-typed by phagetyping, PFGE and antimicrobial resistance profiling, and additionally by MLVA (see box below) during the latter half of the year. In contrast, S. Enteritidis isolates were only analysed by phagetyping. Aside from a single regional point-source outbreak, which was traced to a specific butcher shop, the S. Typhimurium outbreaks listed in Table 2 involved patients from the entire country registered over lengthy periods of time. The sources of these outbreaks or patient clusters were generally difficult to identify.

In 2004, Denmark experienced its first VTEC outbreaks. The largest of these was caused by an O157:H- strain of phagetype 8 that encoded virulence genes *vtx1*, *vtx2c* and *eae*. It involved 25 confirmed cases, all of which were from or near Copenhagen. Initial case interviews suggested the source was a food product purchased in Denmark. A case-control study, involving 11 confirmed patients and 55 controls, clearly indicated that shopping from a specific supermarket chain was associated with the outbreak. This supermarket chain is only operational in the greater Copenhagen area. A specific type of milk produced from a relatively small organic dairy sold in this supermarket chain was also found to be associated with the outbreak, although less tightly linked. After thoroughly disinfecting and revising the procedures at the dairy, no further outbreak cases were reported. Milk and equipment surface samples collected from the dairy after disinfection were found to be negative for VTEC. The herds were not examined. The overall conclusion from this outbreak

Implementation of Multiple Locus Variable number of tandem repeats Analysis (MLVA) for surveillance and outbreak detection of S. Typhimurium

At present, all S. Typhimurium isolates from humans are sub-typed using pulsed-field gel electrophoresis (PFGE) as part of the national surveillance. Unfortunately, the discriminatory power of PFGE is not always sufficient to discriminate within certain phagetypes of S. Typhimurium making it difficult to distinguish between epidemiologically related and unrelated isolates. MLVA is a promising new molecular typing technique that has been developed for sub-typing S. Typhimurium isolates. The technique is based on accessing the genetic variability of tandem repeat areas of the genome. The usefulness of MLVA in surveillance of S. Typhimurium infections was investigated in collaboration with the Norwegian Institute of Public Health. Results showed that MLVA is a useful technique for detecting and investigating outbreaks involving S. Typhimurium. Compared to PFGE, MLVA is faster, reproducible, more discriminatory, the results are more easily interpreted and easier to compare between laboratories, and the technique is more cost efficient.

In Denmark, approximately 90% of all DT104 isolates have the same PFGE type and based on this method alone, it is difficult to discriminate between outbreaks and normal fluctuations in the incidence of infection. In 2004, a higher incidence of DT104 with the same PFGE type was observed during the summer months. In total, 37 isolates were analysed using the MLVA technique and 28 different MLVA types were identified. It was, therefore, concluded that the higher incidence of DT104 was a result of normal seasonal fluctuations.

During the 2004 summer period, phagetype DT12 was the cause of many human infections. Using PFGE, it was possible to differentiate between the isolates and the results indicated a national outbreak with a specific PFGE type. MLVA results for this particular PFGE type identified 20 different MLVA profiles, however, two major groups of isolates were observed. By comparing the MLVA types, the geographical distribution and dates of verification, it was concluded that the increased incidence was due to two distinct outbreaks caused by different MLVA types of DT12. One outbreak occurred in June and July, while the other was confined to a county in Jutland during August and September.

Introduction to the Danish *Salmonella* surveillance

Background

In the late 1800s, the first co-operative movement was established in Denmark. This movement grew fast and in 1888, approximately 600 co-operative dairies were established. The geographical units defined based on these dairy co-operatives have been utilised to eradicate infectious diseases such as *Brucella abortus*. This organisation of producers was the beginning of the relatively unique way of sharing the responsibility of diseases and food safety control between the authorities and the producers/industry.

Strategy

The Danish strategy for controlling *Salmonella* has been based on the need for action, as measured by the incidence of human cases. The surveillance programmes have been initiated by the DVFA in co-operation with the industry, including the food production level. The administration and economy of the programmes are initially the responsibility of the DVFA. When the programmes run smoothly and show acceptable results, the industries gradually take over the administrative responsibilities. Programme financing is also gradually transferred to the industries. However, the DVFA continues to supervise the programmes and are active partners in the process of adjusting the programmes.

Organisation

For each programme, a steering committee and a technical expert committee are appointed. The DVFA chair the steering committees while the industry chairs the technical expert committees. Scientists from the DFVF hold seats in both committees. The tasks of the steering committees include risk management and establishment of general principles of regulation and control. The tasks of the technical expert groups include risk assessment, coordination of activities and technical adjustments. The technical expert groups refer to the steering committees.

investigation was that a very small-scale contamination of a specific type of milk from this dairy was in all likelihood, the source of the outbreak.

The second VTEC outbreak occurred among visitors, primarily children, of a petting farm. This farm housed sheep and goats that the children were allowed to handle. At least five people became infected with various serotypes of VTEC following these visits. VTEC strains identified by PFGE subtyping were isolated from three patients and from droppings. The farm was temporarily closed, but reopened after improved sanitation facilities and measures were in place.

1.3 Surveillance of zoonotic agents in animals and animal products

In Denmark, *Salmonella* monitoring and surveillance programmes have been implemented for all major food animals and food of animal origin. Samples for testing are collected from farms, slaughterhouses and at retail outlets. Monitoring programmes for poultry, pigs and cattle are presented in Tables A15-A17. Sample analysis is performed at authorised private laboratories, RVFCA or the DFVF. Results are reported in central databases and made available for all involved stakeholders including the DVFA, DFVF and the industry (Figure 1, p. 4). In addition, positive *Salmonella* isolates are forwarded to the DFVF for sub-typing (serotyping, phagetyping and antimicrobial susceptibility testing).

The Danish surveillance programme for multi-resistant *Salmonella* Typhimurium DT104 (MRDT104) has been in place since 1998. The programme mandates a zero-tolerance for this pathogen in all foods. Meat imported for 3rd countries and the EU is randomly tested for *Salmonella*. Sample analysis is performed at the RVFCA. If MRDT104 is detected the batch is rejected or heat-treated. The sampling plan for this programme is currently under revision.

Starting in 2003, an intervention strategy aiming at reducing the number of *Campylobacter* positive broiler flocks was initiated. The strategy is voluntary and no regulations have been prepared. All broiler flocks are sampled for *Campylobacter* at the slaughterhouse prior to slaughter, and the samples are analysed using a PCR detection method at the DFVF or at the slaughterhouse.

Pigs and cattle carcasses are screened for *Mycobacterium, Echinococcus* and *Trichinella* (only in pigs) during meat inspection at the slaughterhouse. In

addition, boars and bulls are examined for *Brucella* at semen collection centres. All positive results for notifiable infectious diseases are reported to the DVFA. Surveillance for BSE in cattle and TSE in sheep/goats is outlined in Tables 8 and 10.

An overview of notifiable and not notifiable zoonoses described in the present report, are presented in Table A14 along with the relevant legislation.

1.4 Official testing of zoonotic pathogens in foodstuffs

Monitoring for zoonotic pathogens in foodstuffs is coordinated both at the regional and at the central level of administration. Each RVFCA is responsible for the control carried out in its own region, and the DVFA is responsible for the regulation, control strategy and the surveillance at the overall national level.

The main purpose of the regional microbiological control system is to verify that the own-check programmes implemented at food establishments are functioning effectively and that provisions for these regulations are being fulfilled. Regional microbiological control is carried out as follows:

- Targeted sampling primarily at the retail level. These projects are focused on collecting samples from problematic areas, specific trade facilities, or specific types of food establishments. Targeted samples account for 40% of all samples collected,

- Other sampling at the food wholesale and retail level includes sampling based on suspicion to support findings from inspection of food establishments, sampling at the wholesale level to verify infectious agent limits set by legislation, sampling in relation to the investigation of foodborne disease, or sampling in response to consumer complaints. Such samples account for 30% of the all samples collected from foodstuffs.

Table 3. Centrally coordinated projects, 2004.

Title of project		No. of samples	Parameters for analysis per sample (regional laboratories)
F-RNA bacteriophages in Danish bivalve molluscs and relation to content of *E. coli* and vira pathogenic to humans		600	E. coli F-RNA bacteriophages Pathogenic Vibrio spp.
Enterobacter sakasakii in powdered infant formula		200	*Enterobacter sakazakii*
Salmonella in pasteurised egg-products		600	*Salmonella* (quantitative)
Salmonella , *Campylobacter* and VTEC (O26, O103, O111, O145 and O157) in faeces from sheep/lamb and deer (slaughter animals)		600	*Salmonella* *Campylobacter* VTEC O26, O103, O111, O145 and O157
Campylobacter in fresh Danish broiler meat		2,000	*Campylobacter*
Slaughter hygiene in poultry slaughterhouses	Broilers Turkeys Ducks	100 40 20	*E. coli, Campylobacter*
Salmonella and *Campylobacter* (poultry only) in fresh imported poultry meat and pork		1,000	*Salmonella* *Campylobacter*
Anti-microbial resistance		1,000	*E. coli* *Enterococcus*
Campylobacter in fresh and frozen broiler-meat at the retail level		850	*Campylobacter*
Listeria monocytogenes in cold-smoked, hot-smoked and marinated fish products		1,500	*L. monocytogenes*
Campylobacter in minced beef		100	*Campylobacter*
EU-coordinated control campaign: cheeses prepared from thermised milk		250	Coagulase-positive *Staphylococci, Listeria, Campylobacter, E. coli, Salmonella*
EU-coordinated control campaign: dried spices		500	*B. cereus, Cl. perfringens, Salmonella, Enterobactericeae*
VTEC in faeces from slaughtered cattle (2003)		640	VTEC (O26, O103, O111, O145 and O157)

Centrally co-ordinated control is carried out as national projects or surveys, the purpose of which is to:

- Discover emerging problems with microbiological contaminants,
- Collect data for preparation of risk profiles and risk assessments to support microbial risk management,
- Monitor the effect of established risk management procedures in order to establish if the outcome of these procedures has provided the desired result, or if they need to be reconsidered.

Centrally co-ordinated projects account for 30% of the total samples collected. Table 3 provides information on the centrally co-ordinated projects conducted in 2004.

The findings of *Salmonella* and *Campylobacter* in non-heat treated meat cuts from broiler, turkey, pork and beef products are presented in Tables A6-A9.

The results from the EU co-ordinated control campaign are presented below.

Results for the EU co-ordinated control campaign

Spices and *Salmonella*

Spices are known to be a source of *Salmonella*. They are often grown in hot and humid climates and dried outdoors on the ground, which increases the risk of contamination with pathogens such as *Salmonella*. Therefore, one part of the EU-campagn was aimed at assessing the bacteriological safety of spices and collecting information on the prevalence of certain pathogenic microorganisms, including *Salmonella*. Samples from 366 batches of a large variety of dried spices were collected and examined for the presence of *Salmonella* spp. Samples from 8 batches were found positive (Table I).

Table I. Types of Salmonella *found in dried spices, 2004.*

Type of spice	Type of Salmonella
Cardamom	S. species
Caraway seeds	S . Ball
Cumin	S . Bardo
Curry	S . Montevideo
Paprika	S . Hvittingfoss
Pepper, white	S . Ball
Pepper, black	S . VI, 1,6,14
Thyme	S . Rissen

Source: RVCA

Salmonella, *Campylobacter* and *Listeria* in cheese

Another project involved monitoring of the prevalence of various pathogens in cheese manufactured from thermised milk and from raw milk.

Thermisation is a heat-treatment that is gentler than pasteurisation. The milk is heated for 15 seconds at temperatures between 57°C and 68°C, the lower temperature leads to decreased bactericidal effect, thus increasing the risk of pathogen survival. However, in Denmark the use of thermised milk is only allowed for the production of blue-veined mould cheeses. Special physical-chemical characteristics of these types of cheeses, such as a relatively high salt content combined with a low pH, reduce the growth potential of pathogens.

In Denmark, the use of raw milk for production of cheese is not allowed. However, in connection with production of hard cheeses a dispensation may be given by the authorities because the prolonged maturation period under a physical-chemical condition with low water content is unfavourable for the pathogenic growth.

In total, 140 samples of cheese produced from thermised milk and 9 samples of cheeses produced from raw milk were collected at the manufacturing site, i.e. dairies. All samples were analysed for the presence of *Salmonella*, *Campylobacter* and *Listeria*. No samples revealed the presence of either *Salmonella* or *Campylobacter*. All samples tested for *Listeria* showed < 10 cfu/g (Table II).

Table II. Cheeses produced from thermised and raw milk.

Type of sample	Number of samples	*Salmonella* spp. present in 25 g	*Campylobacter* spp. present in 25 g	*Listeria monocytogenes* cfu[a] < 10 per g.
Cheese from thermised milk	140	0	0	140
Cheese from raw milk	9	0	0	9

[a]cfu: The number of colony forming units

2. Salmonella

2.1 Salmonella in humans

The number of human *Salmonella* infections in Denmark began to rise in the mid 80's. During the following two decades three distinct peaks related to the consumption of broiler meat, pork and table eggs, respectively, were observed. Since 1997, the incidence has steadily decreased (Figure 2). In 2004, this trend continued whereby a total of 1,538 laboratory-confirmed episodes of salmonellosis were reported corresponding to 28.4 cases per 100,000 inhabitants (Table A1). This represents a decrease of 11% compared to 2003 and a three-fold decrease relative to 1997. The reduction in the incidence of human cases may to a large extent be attributed to the large-scale national efforts aimed at reducing the occurrence of *Salmonella* in broilers, pigs and table-egg layers raised in Denmark.

In 2004, the number of reported episodes of S. Enteritidis was 546 corresponding to an incidence of 10.1 per 100,000 (Table A1). This represents a 26% decline compared to 2003 and 85% compared to 1997. Figure 3 shows the geographical distribution of S. Enteritidis cases. The distribution of phagetypes among the 546 human S. Enteritidis isolates is presented in Table A2. The most common phagetypes were PT4 (23.4%), PT8 (20.9%), PT1 (13.7%), PT21 (11.4%) and PT6 (6.2%).

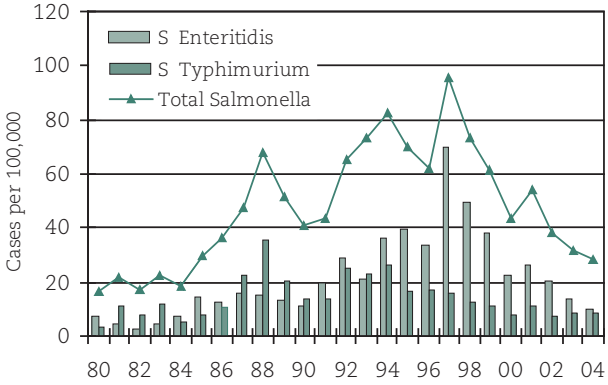

Figure 2. Reported cases of human salmonellosis in Denmark, 1980-2004.
Source: SSI

There were 467 reported episodes of S. Typhimurium corresponding to an incidence of 8.6 per 100,000 inhabitants (Table A1). This is a 4% increase compared to 2003. Figure 4 shows the geographical distribution of S. Typhimurium cases. The distribution of phagetypes (DT) is presented in Table A4, with the most common types being DT12 (17.8%), DT120 (16.1%) and DT104 (9.9%). Unspecified types accounted for 10% of isolates. Multi-drug resistance (i.e. resistance to four or more different classes of amtimicrobials) was observed in 27% of isolates, whereas 43% were susceptible to all drugs tested. In

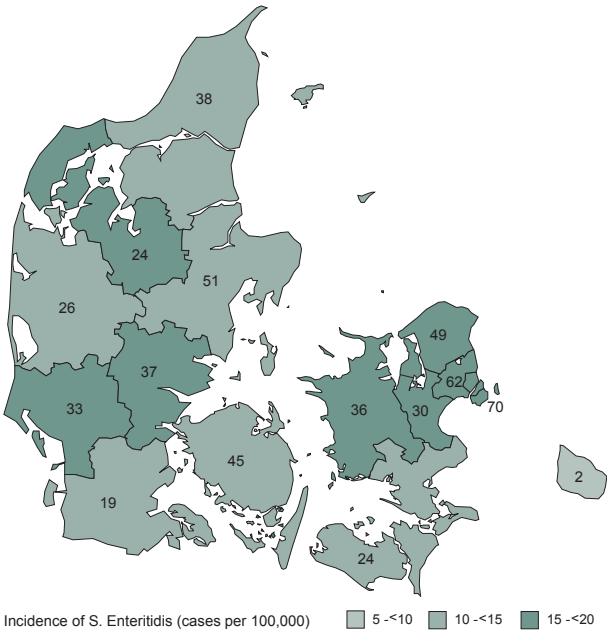

Figure 3. Geographical distribution of the number of cases per county and incidence of human infections with S. Enteritidis 2004.
Source: SSI

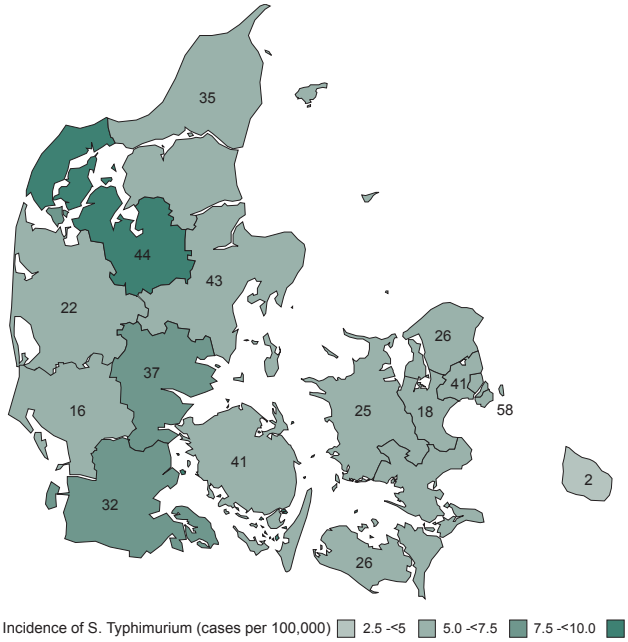

Figure 4. Geographical distribution of the number of cases per county and incidence of human infections with S. Typhimurium, 2004.
Source: SSI

2004, 49 human cases of DT104 and DT104b were reported and 31 (63%) of these were caused by multi-drug resistant strains. The SSI interviewed most patients infected with DT104 or DT104b. Based on patient responses, 33 cases were acquired domestically and five abroad (Figure 5). Four of the travel-related cases were infected with multi-drug resistant strains.

Other *Salmonella* serotypes accounted for 525 episodes corresponding to an incidence of 9.7 per 100,000 inhabitants (Table A1). This is almost the same incidence as in 2003. Of the 101 other serotypes isolated, those most commonly encountered were S. Virchow (38 cases), S. Newport (36 cases), S. Stanley (35 cases), S. Infantis (32 cases), S. Dublin (27 cases), S. Uganda (25 cases), S. Kentucky (18 cases) and S. Saintpaul (18 cases) (Table A3).

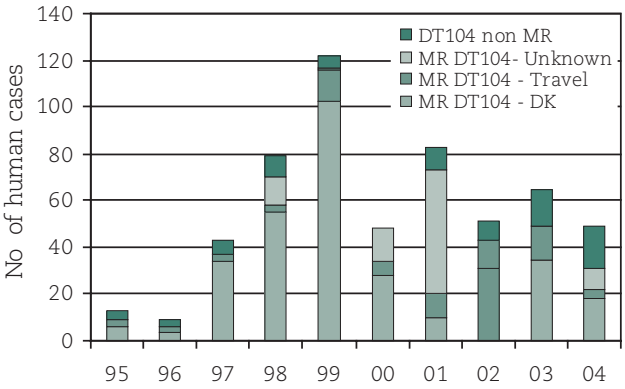

Figure 5. Reported cases of human S. Typhimurium multi-drug resistant DT104 (MR DT104) and non multi-drug resistant DT104 (DT104 non MR), 2004. Both include DT104b.
Source: SSI

2.2 Trends and sources of human salmonellosis

To obtain a better understanding of the dynamics of the occurrence of human *Salmonella* infections, the DZC has applied a mathematical model to estimate the contribution of major animal and food sources to human infections with *Salmonella*. This model is based on a comparison of the number of human cases caused by different *Salmonella* sero- and phagetypes with the prevalence of *Salmonella* types isolated from the various animal-food sources, weighted by the amount of food source consumed. Resistance profiles of S. Typhimurium isolates were also included to further distinguish between similar phagetypes found in animals, food and humans.

In 2004, the estimated mean number of human cases (per 100,000 inhabitants) that could be attributed to various sources of *Salmonella*, was as follows: table eggs (1.9), broilers (0.8) pork (1.9), ducks (0.2), beef (0.6), imported poultry products (4.5), imported beef (0.2), imported pork (1.2), outbreak related cases (0.9), travel (7.7) (see comment below) and unknown source (8.5) (Figure 6). Figure 7 shows the estimated number of cases caused by three major infection sources (broilers, eggs and pork) from 1988 to 2004. Compared to 2003, the number of egg-associated cases continued to decline, which is believed to be a result of the surveillance and control programme implemented in the table-egg production in 1997. Cases related to domestically produced pork also decreased from 3.8 cases per 100,000 inhabitants in 2003 to 1.8 in 2004. Since 2000, the estimated number of cases related to domestically produced pork has varied between 1.1 and 3.8 cases per 100,000 inhabitants. This represents a significant decrease from the 22.0 cases per 100,000 inhabitants estimated in 1993 and is approximately at the same level as found before 1990. The number of broiler-associated cases has remained stable since 2002, at approximately 0.7-0.8 per 100,000.

In 2004, S. Typhimurium phagetypes were the cause of all outbreak-related cases of human salmonellosis. Thirty-four cases were traced to domestic pork, 10 to imported pork products and for 51 cases the source was not identified.

The number of cases reported as travel related is known to be underreported. In previous years, the number of travel-related cases among patients with unknown travel history was estimated using data from cases with a known travel history (i.e. responding yes or no to travel). As in 2003, this approach proved extremely difficult in 2004, since 76% of all patients had no travel information. Furthermore, this proportion varied between *Salmonella* types. For patients infected with a resistant or multi-drug resistant S. Typhimurium infection, travel information was missing for around 30% of the cases, whereas this proportion was 78% for S. Enteritidis cases and 90% for cases infected with fully susceptible S. Typhimurium or with other serotypes. Consequently, estimation of the total number of travel-associated cases in 2004 was based on data from 2002, assuming that travel behaviour had not changed significantly over the last few years. The analyses were further complicated by the fact that similar S. Enteritidis phagetypes were found in imported chicken and travel associated cases. For 2004, we estimated that 416 cases (7.7 per 100,000) were travel related. Of these, 179 cases had reported travelling before onset of disease.

Specifically, for the 467 reported S. Typhimurium cases, 45 were estimated to be associated with travelling and 95 were outbreak related. Of the

domestically and sporadically occurring cases, 82 were associated with Danish produced food and 102 with imported food, whereas the remaining 143 cases had an unknown source of origin. Based on the antimicrobial susceptibility testing, it was estimated that no infections from Danish produced food were multi-drug resistant (resistant to four or more drugs), 1% were quinolone resistant, 62% were resistant (resistant to less than four drugs) and 37% susceptible. In the imported food the same proportions were 4%, 3%, 18% and 75%, respectively. Overall, this indicates that the vast majority of infections with multi-drug resistant S. Typhimurium were acquired from food produced outside Denmark, whereas the majority of infections caused by resistant S. Typhimurium originated from Danish sources.

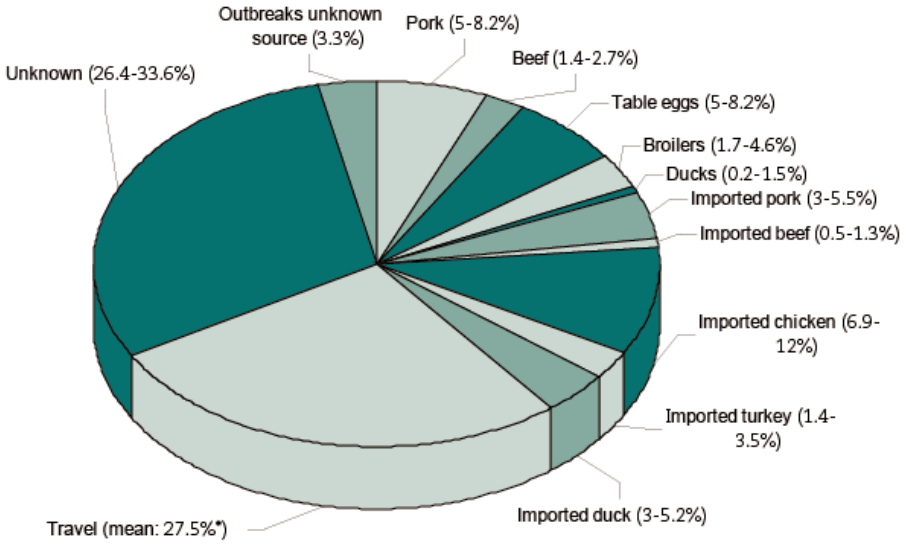

Figure 6. Estimated sources of 1,538 cases of human salmonellosis in Denmark, 2004. The estimated mean number of cases per source: 145 from imported chicken, 37 from imported turkey, 62 from imported duck, 64 from imported pork, 13 from imported beef, 416 travel associated, 100 from pork, 31 from beef, 46 from broilers, 10 from ducks, 100 from table eggs, 51 from outbreaks and 464 of unknown origin.*

* The estimate of travel-associated cases should be interpreted carefully, since data concerning travel history were very poor in 2004.
Source: DZC

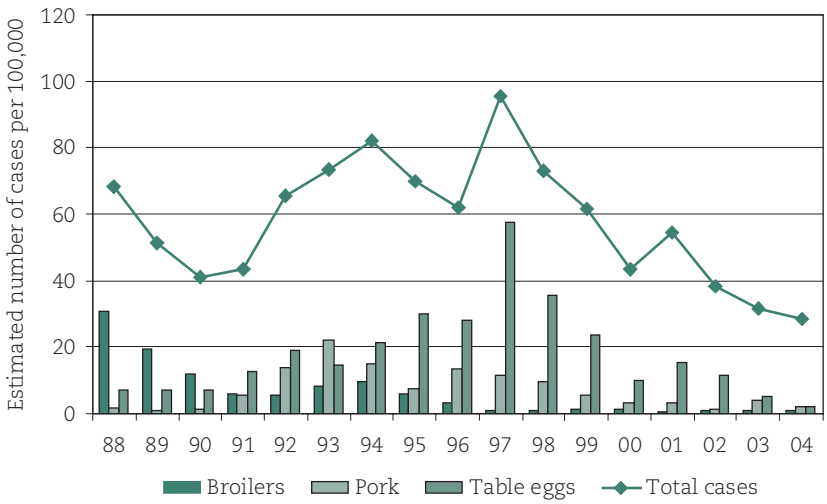

Figure 7. Trends and sources of human salmonellosis in Denmark, 1988-2004.
Source: DZC

2.3 Poultry and poultry products

The national *Salmonella* control programme for poultry implemented in 1996 has been described in previous issues of the Annual Report. The sampling scheme is summarised in Table A15 of this report. The daily administration of this programme is performed by the Danish Poultry Council (DPC) and monitored by the DVFA. Slaughter or destruction of infected parent flocks in compliance with the Zoonosis Directive is covered by governmental funds. The government also reimburses the value of hens sampled from suspected layer flocks. Expenses related to routine sampling are covered by the producers except in small layer flocks, where 75% of the expenses is covered by the government.

Table-egg production

On separate occasions, two central-rearing flocks from the same herd were positive for *S.* Typhimurium and one pullet-rearing flock was positive for *S.* Enteritidis (Table A5). In flocks producing eggs for egg packing stations, *Salmonella* was found in 0.8% in the total number of flocks examined, compared to 2.3% and 2.6% in 2003 and 2002, respectively. A total of 5 flocks were found positive; 2 out of 177 battery flocks, 2 out of 72 deep-litter flocks and 1 out of 175 organically grown flocks. A total of 493 barnyard flocks were examined and 1.2% found to be infected with *Salmonella*. The annual percentage of positive flocks classified by production type is presented in Figure 8. Legislation demands that eggs from the barnyard flocks may be sold directly from the premises only. Testing of flocks producing eggs for consumption within the household of the flock owner is not required as part of the *Salmonella* control programme, but may be done voluntarily.

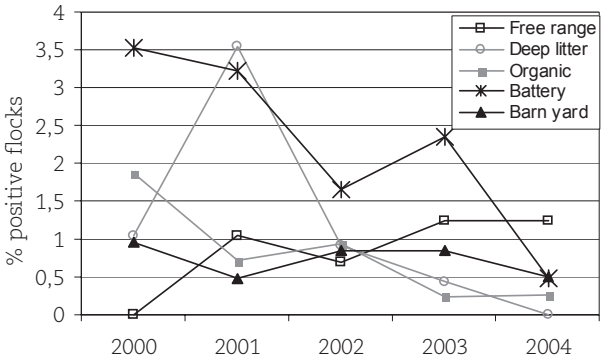

Figure 8. Percent Salmonella *positive table-egg layer flocks according to type of production, 2000-2004.*
Source: DVFA

Broiler production

In total, 283 central rearing flocks were examined and only 1 found to be infected with *Salmonella*. Of the 155 adult breeder flocks examined, 6 flocks from 2 herds were found positive for *Salmonella* (Table A6). One herd was infected with S. Typhimurium and the other herd had an unspecified *Salmonella* infection. In both cases, 3 flocks from the same herd were found infected simultaneously.

All broiler flocks were monitored for *Salmonella* as described in Table A15. In 2004, the number of positive flocks ranged from 0.8% to 2.7% with a mean of 1.5% (Table A6), which is equivalent to that observed in previous years (Figure 9). *S.* Infantis was found in 27.3% and *S.* Typhimurium in 19.7% of the positive flocks. Sero- and phagetype distributions are presented in Tables A2-A4.

The mandatory examination of end-products was carried out through sampling of batches of chicken cuts shortly prior to packaging. A batch is defined as the amount of meat from animals slaughtered between two cleanings and disinfections of the processing equipment. *Salmonella* was detected in 1.6% of these batches (Figure 9 and Table A6), representing a 32% decrease compared to 2003, where 5% of batches were positive.

Turkey production

Since March 1st 2004 turkeys were no longer slaughtered in Denmark, as the only major turkey slaughterhouse closed. Turkeys raised in Denmark were hereafter transported abroad for slaughter. Therefore, only 16 flocks were monitored for *Salmonella* by mandatory AM examination and all were negative. Further, 16 batches were monitored by mandatory end-products examination at the slaughterhouse. One batch was positive with *S.* Typhimurium and one batch with *S.* Hadar and *S.* Saintpaul (Table A7).

Duck production

Duck flocks were monitored by mandatory AM examination prior to slaughter. In 2004, 201 flocks were examined and *Salmonella* was isolated from more than half of these flocks (57.2 %), this prevalence represents a decrease compared to 2003 where 73.3% of the flocks were positive, but is similar to the level observed in 2002. In several cases, more than one serotype was isolated from each flock. *S.* Anatum was the most frequently isolated serotype (Table A3).

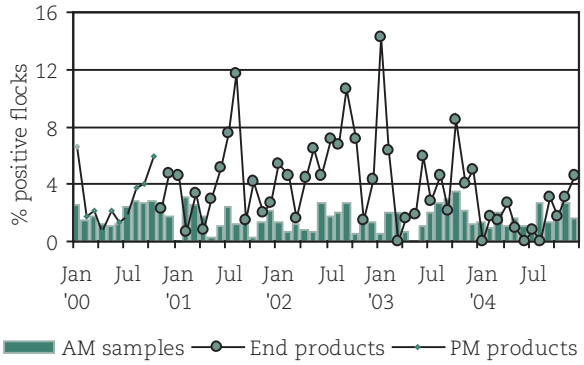

Figure 9: Percent Salmonella *positive broiler flocks detected at the mandatory Ante-Mortem (AM) and end-product examination, 2000-2004. Post-Mortem (PM) examination was replaced by end-product examination in November 2000.*
Source: DVFA and DPC

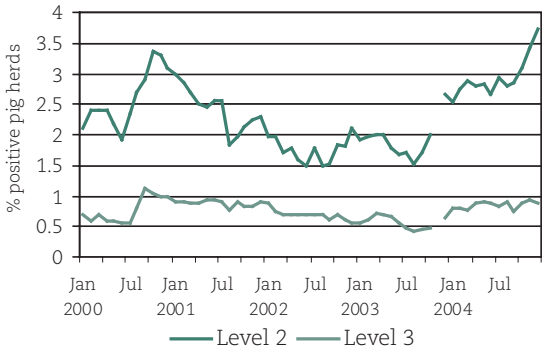

Figure 10. Serological surveillance of Salmonella *in pig herds. Percentage of pig herds in level 2 and 3, 2000-2004.*
Source: DVFA

2.4 Pigs and pork production

In 1995, a serological surveillance programme for detection of *Salmonella* infection in slaughter-pig herds was implemented. The programme has been adjusted over the years and revisions have previously been described in Annual Reports 2000-2002. The sampling scheme is summarised in Table A16. Originally, the DVFA was responsible for the administration of the programme. However, since May 2002, the Danish Bacon and Meat Council (DBMC) has carried out the daily administration supervised by the DFVA. All data from the surveillance of *Salmonella* in pigs are registered in the central Zoonosis Register database, which is part of the Central Husbandry Register, administered by the DVFA.

Surveillance by serological testing of meat juice (approx. 600,000 meat-juice samples per year) is carried out in herds producing more than 200 slaughter pigs per year. These results are used to assign the herds to one of three levels, based on the proportion of sero-positive meat-juice samples collected over the last three months. The sample results are weighted, such that results from the most recent month are weighted more heavily than those from previous months. Level 1 herds are classified as having none or a small proportion of positive samples, Level 2 has a higher proportion of positives, and Level 3 herds have an unacceptably high proportion of positive samples. Pigs from Level 3 herds must be slaughtered under special hygienic precautions. It is mandatory to collect pen-faecal samples from herds placed in level 2 or 3 in order to clarify the distribution and type of the *Salmonella* infection. The numbers of level 2 and 3 herds rose during 2004, and by the end of the year, 3.5 % of herds were assigned to level 2 and 1.1 % to level 3 (Figure 10). With a few exceptions, all sow herds supplying piglets to slaughter-pig herds in level 2 or 3 are obligated to collect pen-faecal samples for determining the distribution of *Salmonella* within the herd, and to clarify possible transmission of *Salmonella* from sow herds to slaughter-pig herds.

Breeding and multiplying herds are monitored monthly through serological testing of blood samples. If the set threshold is exceeded, the herd owner is obligated to collect pen-faecal samples (Table A16). An increase in the number of breeding and multiplying herds reaching the threshold level was observed in 2003, peaked during 2004 and was followed by a minor decline. This in combination with the rise in number of herds assigned to level 2 and 3 indicated a general increase in the prevalence of *Salmonella* in pig herds, which instigated an investigation. The investigation did not identify a single cause for the increase and a report describing a number of possible initiatives for reversing this trend is currently in preparation.

Clinical disease in combination with findings of *Salmonella* was recorded in 45 herds (Table 4). This represents the number of herds submitting material from clinically affected animals to the laboratory with findings of *Salmonella*. Eight herds were placed under official veterinary supervision due to salmonellosis.

Monitoring of *Salmonella* in pork is based on swab samples taken from three designated areas of chilled half-carcasses at the slaughterhouse. Samples from 5 carcasses are pooled, except in slaughterhouses slaughtering 50 pigs or less per month in which case, samples are analysed individually. When determining the prevalence of pooled samples, the loss of sensitivity and the probability of more than one

sample being positive in each pool are taken into consideration. A conversion factor has been determined on the basis of comparative studies, as described in the Annual Report 2001. In 2004, 33,890 samples were pooled and the prevalence of *Salmonella* was 1.3% (Figure 11 and Table A8). An additional 148 samples were collected from slaughterhouses with a low production and were analysed individually. Of these, two samples were found positive for *Salmonella*. Like in previous years, the most common serotypes observed were S. Typhimurium, S. Derby and S. Infantis. The sero- and phagetype distributions are presented in Tables A2-A4.

2.5 Cattle and beef production

A national programme for surveillance of S. Dublin was established in 2002. This programme divides the cattle herds into three levels. Level 1: Most likely S. Dublin free, level 2: S. Dublin is most likely present, or the herd has unknown status, and finally, level 3: S. Dublin has been isolated from the herd, or the herd owner has purchased animals from a known level 3 herd. The herds are assigned to levels based on serological results from milk and blood samples or on account of contact with a herd assigned to a more infectious level. The S. Dublin surveillance programme was described in the Annual Report 2003 and the sampling scheme is summarised in Table A17.

In 2004, 19.5% of milk-producing herds was classified as level 2 (Table 5), which is a significant decrease compared to 2003 where 25.9% of the herds were assigned to level 2. It is believed that changes in trading habits among farmers are major contributors to this decrease, i.e. since 2003 very few animals from level 2 have been sold to level 1 herds.

In February 2004, the validity period for blood samples in non-milk producing herds with more than 24 animals was changed from 12 to 4 month. However, this was not implemented until mid-2004 and many herds did not have valid tests results for the second half of 2004. Therefore, a large increase in the number of herds in level 2 (herds with unknown S. Dublin status) was recorded by December 2004. In total, 44.3% of the herds were assigned to level 2, compared to 23.5% herds in December 2003.

Herds with salmonellosis are placed under official veterinary supervision and animals from these herds are slaughtered under special hygienic precautions. However, in herds with S. Dublin, where the disease is confined to a minor part of the herd, it may only be subjected to hygienic slaughter.

Table 4. Isolation of Salmonella *from outbreaks of clinical disease in pig and cattle herds, 2004*

Serotype	Pigs herds	Cattle herds
Brandenburg	1	
Derby	8	-
Dublin	-	25
Idikan		1
Infantis	2	
Livingstone	2	-
Typhimurium		
MRDT104		1
Other Typhimurium	31	15
Worthington	1	-
TOTAL	45	42

Source: DVFA

Table 5. No. of cattle herds assigned to level 1-3 according to the S. Dublin surveillance, December 2004.

S. Dublin Level	Milk producing herds	Non-milk producing herds
Level 1	5065	11426
Level 2	1231	9108
Level 3	7	8

Source: The DVFA

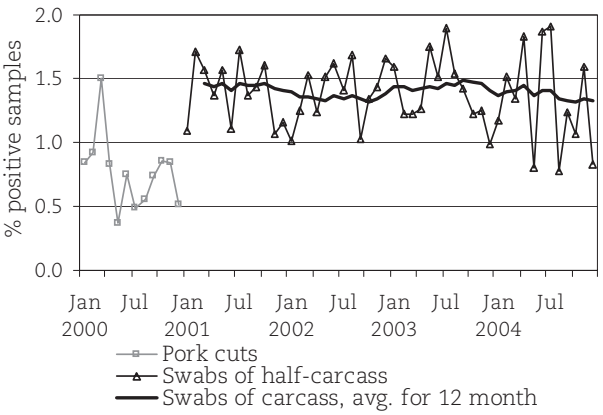

Figure 11. Salmonella *in pork, monitored at slaughterhouses, 2000-2004. Swab samples from three designated areas of chilled half carcasses.*
Source: DVFA

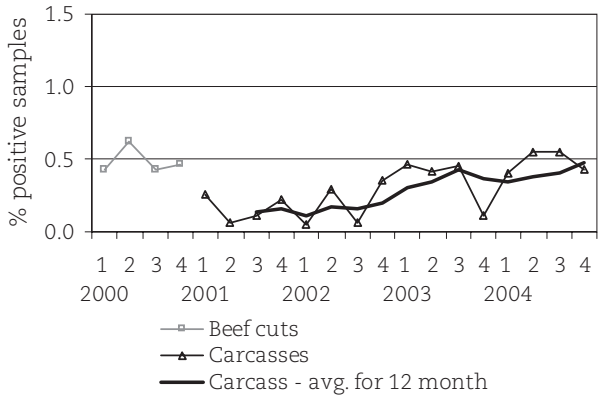

Figure 12. Salmonella *in beef, monitored at slaughterhouses, 2000-2004. Swab samples taken from 3 designated areas of chilled half carcasses.*
Source: DVFA

Clinical disease in combination with the finding of *Salmonella* was recorded in 42 herds (Table 4). Of these, 29 herds were placed under official veterinary supervision, while 6 were subject to hygienic slaughter due to confirmed infections of S. Dublin. One herd was placed under Zoonosis supervision, the official veterinary supervision, due to finding of multi-drug resistant S. Typhimurium DT104.

Monitoring of *Salmonella* in beef and veal at slaughterhouses is based on swab samples taken from three designated areas of chilled half-carcasses. Samples from 5 carcasses are pooled, except in slaughterhouses slaughtering 50 cattle or less per month in which case, the samples are analysed individually. In 2004, 10,695 samples were pooled and the prevalence of *Salmonella* was 0.5% after using the conversion factor in the same manner as described for pork (Figure 12 and Table A9). An additional 845 samples were collected from slaughterhouses with a smaller production and were analysed individually. Of these, 5 were positive for *Salmonella*. S. Dublin was isolated from 65,7% of the positive samples (Table A3).

2.6 Imported meat and meat products

The Danish surveillance programme for multi-drug resistant *Salmonella* Typhimurium DT104 (MRDT104) has been in place since 1998 and was described in the Annual Report 2001. The programme mandates a zero-tolerance for this pathogen in all foods. Meat imported from 3rd countries and the EU is tested for *Salmonella* at either the entry point into EU or at the place of destination. If MRDT104 is detected the batch is rejected or heat-treated. The sampling plan for this programme is currently under revision.

The surveillance programme also provides information on the prevalence of other *Salmonella* types than MRDT104 in imported meat. The sampling programmes for imported and Danish fresh meat from poultry, pork and beef are very different, and comparison of the results should be done carefully. Still, the results indicate that the prevalence of *Salmonella* in imported poultry and pork is higher than the prevalence in Danish produced poultry and pork.

In 2004, a total of 935 batches of imported fresh meat were examined for *Salmonella* MRDT104. Of these, 1.7% were found positive compared to 1.1% in 2003 (Table A10). Overall, 19.1% of the batches were found *Salmonella* positive, which represents an increase of 3% compared to 2003. The increase was most significant in pork, where 28.5% of the batches were found positive in 2004 compared to 17.0% in 2003 (Figure 13). At the same time, the number of examined batches of pork increased by approximately 40.0% (Figure 14). For chickens/hens the number of positive batches decreased slightly from 37.0% in 2003 to 31.1% in 2004. No changes were observed in the number of positive batches of turkey or beef.

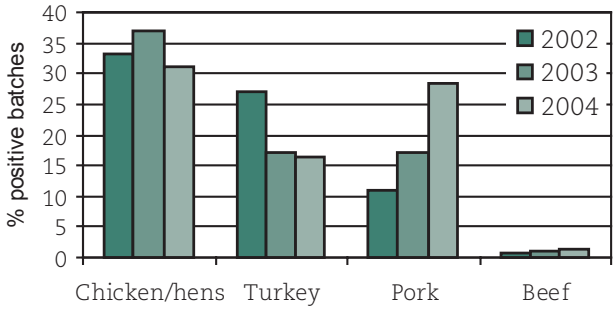

Figure 13. Percent Salmonella *positive batches from the import control, 2002-2004*
Source: DVFA

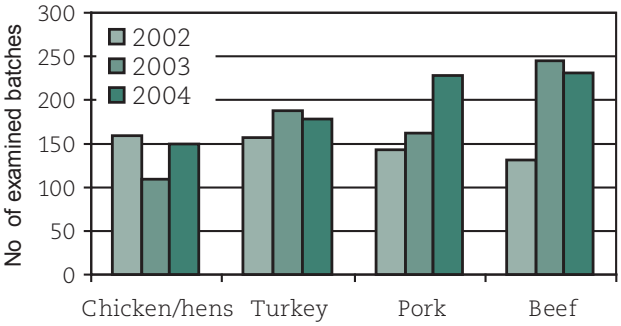

Figure 14. Number of examined batches from the import control, 2002-2004
Source: DVFA

2.7 Feeding stuff

The Danish Plant Directorate (PD) inspects all feed compounders for the presence of *Salmonella*. This inspection includes sampling of feed materials as well as sampling during feed processing (environmental samples). Further details are described in the Annual Report 2000.

In 2004, the strategy for controlling *Salmonella* in feeding stuffs was revised as follows:

- Routine inspections of feed processing plants continued,
- Sampling of compound feeds discontinued. The presence of *Salmonella* in compound feed is now indirectly monitored by the environmental samples collected during feed processing,
- Sampling of feed materials increased from 300 samples to 1000 samples per year and the sampling method was modified,
- Samples from transport vehicles were collected (hygiene samples) prior to loading of feed compounds.

In general, the prevalence of *Salmonella* in feed was low, however due to changes in the sampling strategy and sample size of feed materials, the results from 2004 and 2003 are not readily comparable. Results are shown in Table A11.

2.8 Rendering plants

Three different categories of meat and bone meal by-products, not intended for human consumption, have been set by regulation No. 1774 of 03/11/2002. Category 1 and 2 material must be processed at special processing plants and by-products of these cannot be used for feeding purposes. Category 3 materials must be by-products from healthy parts of animals and processed at category 3 processing plants. These materials may be used for feeding purposes.

Monitoring of hygiene at the processing plants is mainly based on the plant's own-check programmes, which are inspected by the RVFCA. Positive *Salmonella* samples must be reported to the RVFCA. In 2004, 7,979 samples of meat and bone meal were examined for *Salmonella*. Of these, 4,180 were collected as a part of the plants' own-check programme and the remaining 3,799 samples as controls of the products. In total, 2.1% samples were found positive for *Salmonella* and all isolates were serotyped. *S.* Montevideo was the most common serotype found (Table A12).

2.9 Pets, zoo animals and wildlife

A small number of samples from pets, zoo animals and wildlife are tested for *Salmonella* at the DFVF. As in previous years, samples from pets were tested on clinical indication only and none of the examined dogs and cats was found positive for *Salmonella* in 2004. Zoo animals examined for *Salmonella* were mainly reptiles, and less than 5% of these were found positive. Of the wild animals submitted to DFVF by hunters, veterinarians and the public, *Salmonella* was isolated from 2 foxes. The *Salmonella* testing results for pets, zoo animals and wildlife are shown in Table A13.

3. Campylobacter

3.1 Humans

Since 1999, campylobacteriosis has been the single leading cause of bacterial gastrointestinal disease in Denmark. In 2004, there were 3,724 reported cases (Table A1), with an incidence of 68.8 cases per 100,000 inhabitants (Figure 15). Following two years of decline, this was a 5.1% increase in confirmed laboratory cases compared to 2003. However, the number of cases was still lower than in 2002 (4,378 cases). Consumption and handling of poultry and poultry products is believed to be the primary source of human campylobacteriosis in Denmark, though other sources also exist. Data on travel history is currently not reliably recorded in the surveillance system; therefore, the incidence of people infected outside Denmark is unknown. It is estimated that approximately one third of cases are travel related. The geographical distribution of human infections caused by *Campylobacter* is shown in Figure 16. Outbreaks of human campylobacteriosis are rare. They are identified and recorded in the same manner as *Salmonella* outbreaks and are summarised in Table 1. The incidence of *Campylobacter* in humans has a distinct seasonal distribution, with a summer peak in June-September (Figure 17).

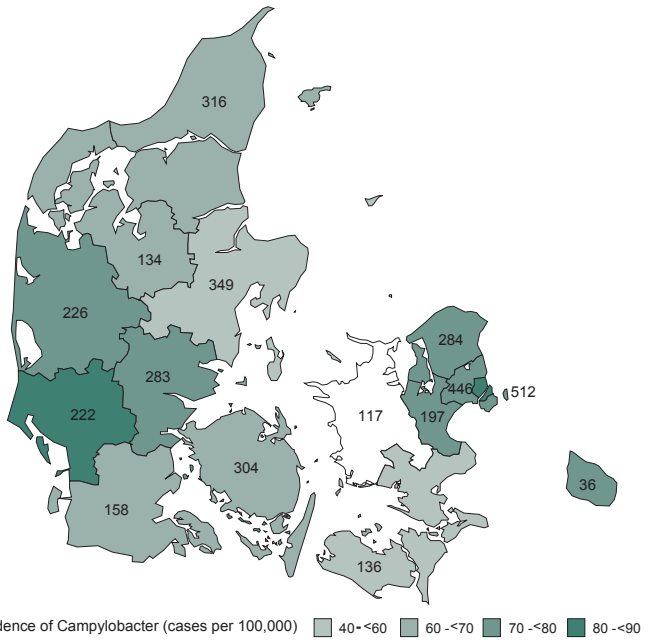

Figure 16. Geographical distribution of the number of cases per county and incidence of human campylobacterioisis, 2004.
Source: SSI

3.2 Poultry

A voluntary intervention strategy aimed at reducing the number of *Campylobacter* positive broiler flocks was implemented in 2003 and continued in 2004. This strategy is described in the Annual Report, 2003. All broiler flocks were sampled for *Campylobacter* at the slaughterhouse prior to slaughter, and the samples were analysed using a PCR detection method. In 2004, there were 27.0% *Campylobacter* positive flocks (Table A6); which is a significant decrease compared to the years prior to implementation of the strategy, where the prevalence was greater than 35% (Figure 19). Although samples were collected from the flocks following transport to the slaughterhouse, it is believed that the observed prevalence reflects the flock status at the farm. Therefore, the significant reduction in prevalence is considered to be attributable to the enforcement of intervention strategies including strict hygiene and bio-security measures at the farm and higher prices paid to the farmers delivering *Campylobacter* negative flocks.

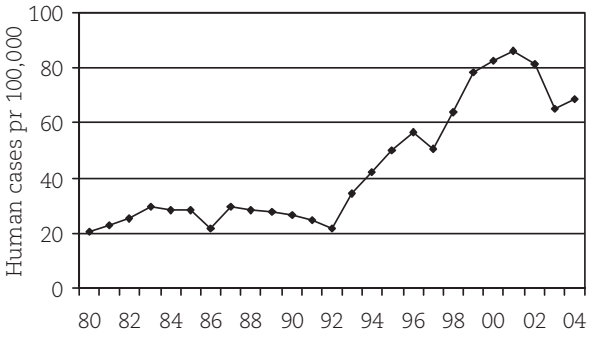

Figure 15. Incidence per 100.000 of human campylobactoeriosis in Denmark, 1980-2004.
Source: SSI

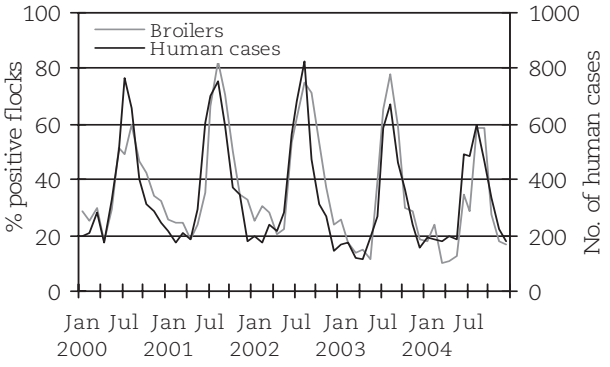

*Figure 17. Percent*Campylobacter *positive poultry flocks and no. of positive human cases, 2000-2004.*
Source: SSI, DFVF

As for human campylobacteriosis, the prevalence in broilers has a distinct seasonal variation, with a summer peak in July/August. In 2004, the percentages of positive broiler batches per month ranged from 10.4% in March to 58.6% in August (Figure 17).

The gradual decline in the prevalence of *Campylobacter* infections in broiler flocks from 1998 through 2002 does not coincide with the human trend. In fact, the number of human cases showed an overall increase of 37.0% from 1998 to 2001. However, in 2002 the number of human cases decreased by 5.2%, and again by 19.5% in 2003 (Table A1). This significant decrease coincides with the implementation of the voluntary intervention program in broilers. It is likely that the practice of allocating *Campylobacter* negative flocks to the production of fresh products and *Campylobacter* positive flocks for frozen product production, although not completely consistent, contributed to the reduction in human cases.

The PCR-method used in surveillance of *Campylobacter* does not differentiate between species of *Campylobacter*; however, as part of the monitoring programme for the occurrence of antimicrobial resistance in zoonotic bacteria (DANMAP), one flock from each broiler house was examined for *Campylobacter* spp. by conventional microbiological methods. Each sample consisted of 10-pooled cloacal swabs. Of the 520 samples investigated, 19.4% were found to be positive for *Campylobacter*. Of these, 94.1% were identified as *C. jejuni* and 5.9% as *C. coli*.

No flocks of hens, ducks or turkeys were tested for *Campylobacter* in 2004.

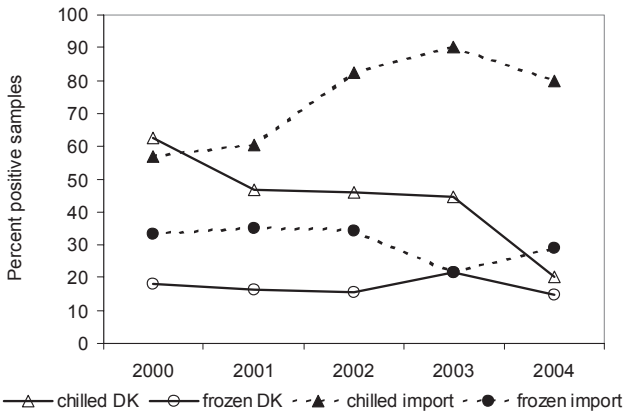

Figure 18. Percent Campylobacter *positive samples from chilled and frozen, Danish and imported chicken meat.*
Source: DFVF

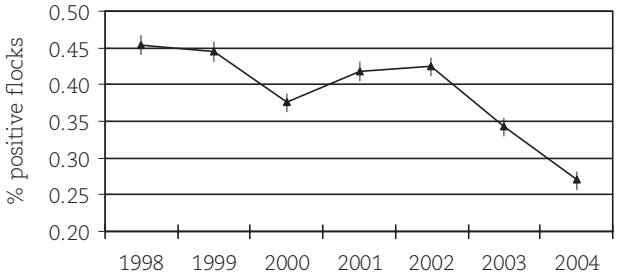

Figure 19. Percentage of broiler flocks infected with Campylobacter, *1998-2004.*
Source: DFVF

As in the preceding years, the prevalence of *Campylobacter* in chilled and frozen fresh poultry meat was monitored in 2004. The samples were taken at wholesale or retail level and include Danish produced as well as imported meat (Table A6 and A7). The results showed a slight decline in the prevalence of *Campylobacter* in Danish produced chicken (Figure 18). As for the previous years the prevalence, as well as the number of *Campylobacter*, was higher in chilled products.

In addition, in 2004 a surveillance of chilled products was performed at the two major slaughterhouses producing chilled broiler products. Samples of packaged products were taken weekly, and the results were linked with the status of delivering flocks. Of 1,601 samples 286 (17.9%) were positive. This surveillance continues in 2005 and 2006.

3.3 Pigs and cattle

As part of the DANMAP programme, caecal content of pigs and cattle was sampled at slaughterhouses and examined for *Campylobacter*. In 2004, the prevalence of *Campylobacter* in pigs was 79.6%. The majority of the positive samples was identified as *C. coli* (Table A8). In cattle, the prevalence was 64.2% with the majority of isolates identified as *C. jejuni* (Table A9).

3.4 Pets, zoo animals and wildlife

Samples from pets are not routinely monitored for *Campylobacter* at the DFVF, and only samples submitted on clinical indications for *Campylobacter* analysis are examined. *Campylobacter* was isolated from 3 of 7 samples examined from dogs and from 4 of 8 examined cats. In zoo animals, *Campylobacter* was found in 10 of 20 animals. One wild animal was examined and found negative for *Campylobacter* (Table A13).

4. Yersinia

Yersiniosis is notifiable by laboratory in humans, but not in animals.

4.1 Humans

In 2004, there were 227 reported infections with *Yersinia enterocolitica* (4.2 cases per 100,000 inhabitants), which is 7% fewer than in 2003 (Table A1). Over the past five years, the annual number of infections has been fairly stable. Overall, infections with *Y. enterocolitica* have been steadily decreasing since 1985, where more than 1,500 cases were reported (Figure 20). As in previous years, the majority of isolates (88%) were serotype O:3. Generally, the infections were domestically acquired and the majority of patients were children with the median age of patients being 7 years. The primary source of human yersiniosis in Denmark is believed to be pork and pork products. The geographical distribution of human *Y. enterocolitica* cases is presented in Figure 21.

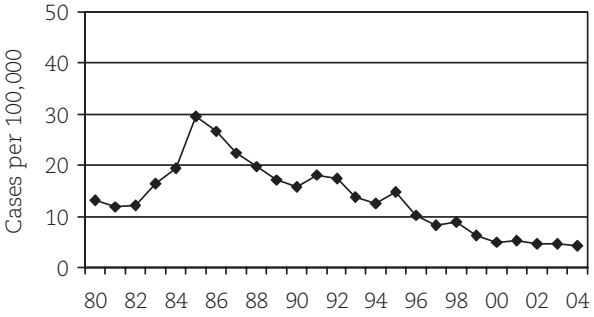

Figure 20. Incidence per 100,000 of human yersiniosis in Denmark, 1980-2004.
Source: SSI

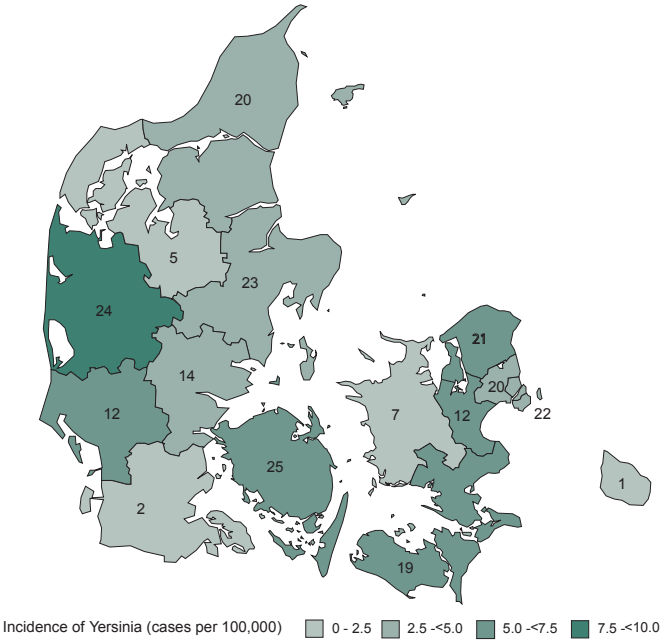

Figure 21. Geographical distribution of the number of cases per county and incidence of human yersiniosis, 2004.
Source: SSI

4.2 Pigs

As part of the DANMAP programme, caecal contents were sampled from randomly selected pig herds at slaughterhouses and tested for *Y. enterocolitica*. In 2004, a total of 576 animals were tested, representing 576 herds, and 10.4% were found positive for *Y. enterocolitica* (Table A8).

5. Listeria

Listeriosis is notifiable by laboratory in humans, but not in animals.

5.1 Humans

In 2004, there were 41 reported cases of listeriosis corresponding to an incidence of 0.8 cases per 100,000 inhabitants (Table A1). Thirty-three cases presented with septicaemia, four with meningitis, three were classical maternofoetal cases, and one case presented with peritonitis. The patients came from all parts of Denmark. Based on sero-grouping, ribo-printing, and PFGE typing, no clusters could be identified. Twenty cases were assigned to serogroup 1 and 19 cases to serogroup 4, while the serogroup was undetermined for two cases. During the last 20 years, the incidence of listeriosis has been stable between 0.4 and 0.8 cases per 100,000 inhabitants (Figure 22).

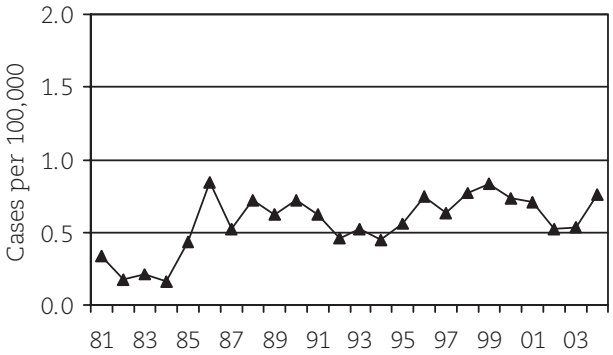

Figure 22. Incidence per 100,000 of human listeriosis in Denmark, 1981-2004.
Source: SSI

5.2 Ready-to-eat food

Since 1998, Denmark has had guidelines on assessment of findings of *Listeria monocytogenes*. These guidelines distinguish between products supporting growth of Listeria and products not supporting growth and cover all ready-to-eat foods. For products supporting growth within the shelf-life, findings of *L. monocytogenes* is unacceptable. For products not supporting growth within the shelf-life, findings of *L. monocytogenes* up to 100 cfu (colony forming units)/g is accepted. The results of the monitoring carried out by the RVFCA for *L. monocytogenes* in different food categories is summarised in Table 6.

In 2004, a centrally coordinated project (see describtion page 8) was organised for *L. monocytogenes* to test smoked and marinated fish products. A total of 1,339 samples were analysed. Each sample was analysed using both qualitative and quantitative methods. *L. monocytogenes* was detected in 10.3% of samples. A total of 0.8% of samples were found to contain between 10 and 100 *L. monocytogenes* cfu/g., and 0.2% of samples were found to exceed 100 *L. monocytogenes* cfu/g.

Table 6. Listeria monocytogenes in ready-to-eat foods sampled by the RVFCA, 2004.

Food category	Samples analysed by a qualitative method	Positive samples[a]	Samples analysed by a quantitative method	Samples with cfu[b]< 10/g	Samples with 10/g<cfu<100/g	Samples with cfu>100/g
Meat products	109	2	397	395	1	1
Milk and dairy products	117	0	6	6	0	0
Eggs and egg products	5	0	0	0	0	0
Fruit and vegetables	0	0	26	24	2	0
Fishery products	58	29	251	250	1	0
Other products	27	2	90	89	1	0
Total	316	33	770	764	5	1

[a]*Listeria monocytogenes* present in a 25 g sample of the product.
[b]cfu: The number of colony forming units.
Source: DVFA

6. Verocytotoxin-producing Escherichia coli (VTEC)

VTEC infections are notifiable by laboratory in humans, but not in animals. HUS is notifiable in humans.

6.1 Humans

In 2004, there were 168 reported episodes of verocytotoxin producing *Escherichia coli* (VTEC) infections with an incidence of 3.1 per 100,000, 28.0% of which were caused by O157 (Table A1). The annual number of episodes has been steadily increasing since 1997 (Figure 24). The overall increase is in part due to improved diagnostic methodologies and increased awareness. 2004 represented a 30% increase compared to 2003. Two outbreaks that occurred in 2004 explained a major part of the increase from 2003 to 2004 (see section 1.2). The geographical distribution of human VTEC infections is presented in Figure 23.

Five cases of HUS were reported in 2004. None were fatal. VTEC strains were isolated from all cases, three of O-group O157 and one each of O-group O104 and O26. As for most other human zoonotic pathogens, Denmark does not have a centrally coordinated standard testing method for VTEC. Laboratories testing samples from approximately 50% of the Danish population use molecular detection methods (PCR or dot blot hybridisation), which detect verocytotoxin genes, followed by slide agglutination and further typing methods. Most of the remaining laboratories use slide agglutination of suspect colonies, with OK-antisera against the most common VTEC and EPEC serotypes for microbiological diagnosis. At a few laboratories verocytotoxin-specific ELISA detection is used. In 2004, all VTEC isolates were real-time sub-typed using PFGE at the SSI. The total distribution of VTEC O-groups, resulting in five or more episodes is presented in Table 7.

6.2 Cattle

The DFVF has monitored the occurrence of VTEC O157 in cattle since 1997 through examination of faecal samples from slaughter calves. These samples were collected at the slaughterhouses as part of the DANMAP programme. In 2004, VTEC O157 was detected in 6.8% of faecal samples from slaughtered calves (Table A9). There is a seasonal variation in the findings of VTEC O157 in slaughtered calves, as all VTEC O157 shedding animals were detected between April and October. During this period, the prevalence was 11.4% (17 positive animals out of 149 examined). This seasonal variation has also been observed in previous years.

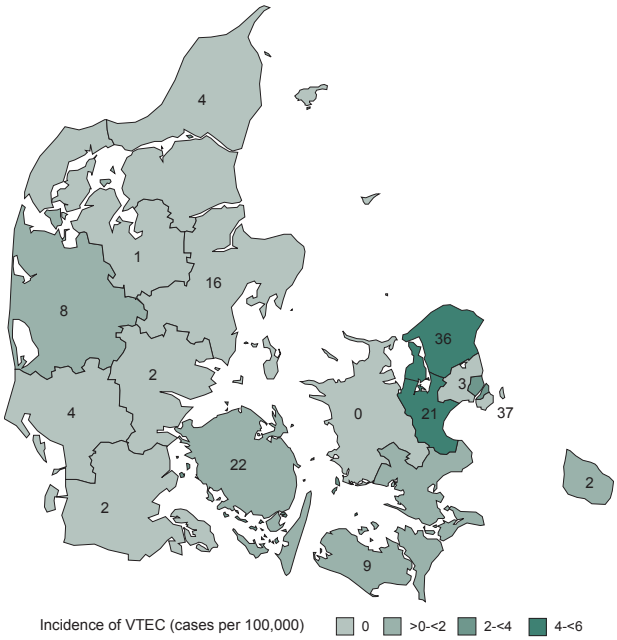

Figure 23. Geographical distribution of the number of cases per county and incidence of human infections with verocytotoxigenic E. coli (VTEC), 2004.
Source: SSI

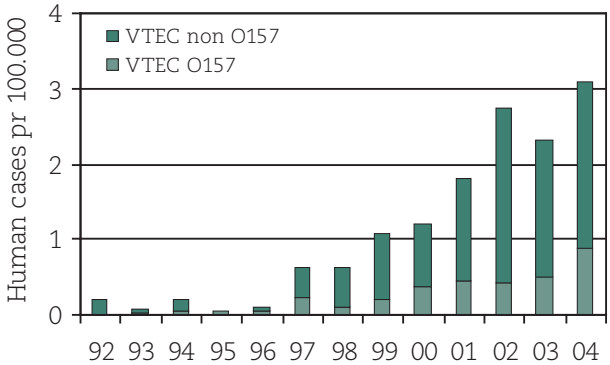

Figure 24. Incidence of human infections with verocytotoxigeninc E. coli. 1992-2004.
Source: SSI

Table 7. VTEC O-group distribution in 2004. All O-groups that resulted in five or more episodes are listed.

O group	Number of episodes
O157	47
O103	16
O26	13
O146	9
O117	5
O Rough	10
Other O groups	68
Total	168

Source:SSI

7. Transmissible Spongiform Encephalopathy

7.1 Humans

The human form of variant Creutzfeldt-Jakob disease (vCJD) has never been reported in Denmark. Since 1997, vCJD has been a notifiable disease in Denmark.

7.2 Cattle

The Danish surveillance program has continued throughout 2004, but with minor changes to the programme (for legislation see Table A14). BSE testing of samples from slaughtered animals is performed at three approved private laboratories in Denmark. Two of these laboratories employ the Enfer Test (ELISA) using spinal cord and brain stem material, while the third laboratory employs the Prionics Check Test (Western blotting) and tests only brain stem material. All animals-at-risk have brainstem samples tested by Western blot technique (risk categories presented in Table 8). Fallen stock is generally tested at an approved private laboratory, but a fraction of samples from risk animals are examined at the DFVF to maintain routine testing practices at this institute. The DFVF also receives clinically suspected animal samples for diagnosis and performs confirmatory testing on samples where the results are initially positive or inconclusive.

During 2004, Denmark tested a total of 246,591 healthy slaughter animals. Among these, no animals were positive for BSE. A total of 37,658 fallen stocks were also tested, and one was found to be positive for BSE (Table 8). The positive animal was a 14-year-old beef cow, and the brain damage was found to be similar to the Italian cases of atypical BSE. This was the first confirmed case of atypical BSE in Denmark.

The geographical distribution of BSE positive herds identified from 2000-2004 is shown in Figure 25.

For several years, the EU Commission has encouraged the OIE (World Organisation for Animal Health) to work towards a simplification of the methodology and legislation for BSE country classification between countries. At the end of 2002, the Veterinary Laboratory Agencies (VLA, UK) was invited to formulate a new algorithm for calculating the prevalence of BSE. This new model (BSurvE) was presented in 2003 and discussions on the topic have since then taken place within the EU framework. Subsequently, in 2004 this algorithm (BSurvE) was submitted from the EU to OIE, who later proposed a simpler version created. This proposal is currently under consideration by the EU.

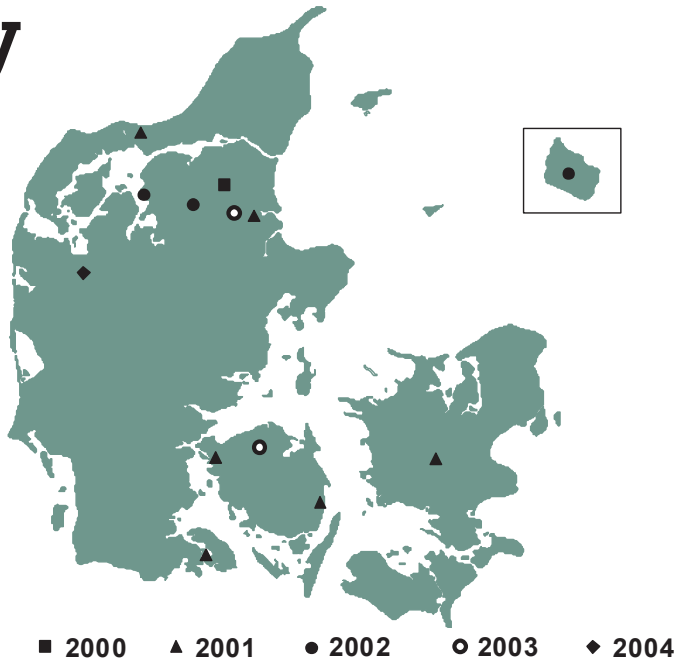

Figure 25. Geographical distribution of BSE positive herds in Denmark, 2000-2004.
Source: DVFA

Using the newly developed epidemiological model and the results from the Danish BSE surveillance program for the period from 2001 to 2004, the DFVF has developed a prediction model for the expected number of BSE cases in Denmark for the period from the year 2005 to 2010 (Figure 26). The current version of this model assumes a 100% effective feed ban as of January 2001, an assumption for which, to date, no validation data can be produced. According to this prediction, the eradication of BSE in Denmark has nearly been accomplished.

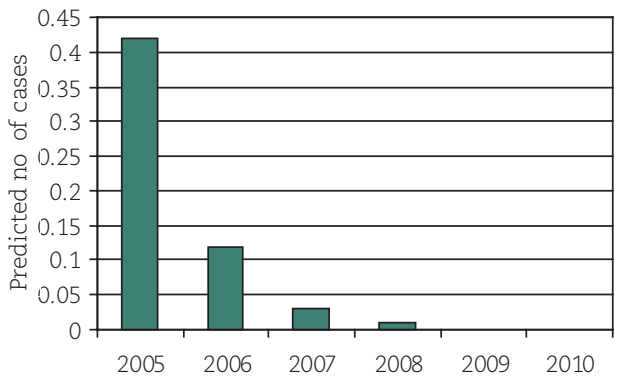

Figure 26. Predictions of the expected number of BSE cases 2005-2010.
Source: DFVF

7.3 Sheep and goats

It has been demonstrated that under experimental conditions, sheep can contract BSE and there has been great concern that this phenomenon may also occur under field conditions. Late in 2004, the first case of BSE in a goat was confirmed in France and sent for final confirmation at the VLA. This confirmation came in January 2005 and a Commission proposal regarding a BSE monitoring/surveillance program involving testing of all slaughtergoats has subsequently been adopted.

Some sheep have genotypes that are resistant to scrapie. Although less conclusive, evidence also suggests that these same genotypes are resistant to BSE. The pathogenic prion load in these resistant sheep is much lower than in non-resistant sheep. Therefore, the resistant sheep will pose a much lower public health risk, compared to that of non-resistant sheep. In 2004, a study was conducted to determine the prion genotype from a sample of ovine animals following EU regulation No. 999/2001 (as amended). This study consisted of a sampled population of 100 randomly selected animals. Results showed that 20% of sheep had the resistant prion genotype ARR/ARR (Table 9).

As outlined in Table 10, all fallen stock older than 18 months of age were tested for BSE and scrapie following the same procedure that was described for cattle, using brain stem material for testing in all cases. In cases, where rapid tests showed positive or inconclusive results at one of the private laboratory, samples were subjected to confirmatory testing at the DFVF, who employed histopathology and immunohistochemistry technologies to obtain conclusive results. Scrapie has never been detected in sheep or goats in Denmark. From 2004 regulation no. 36/2005 dictates that a sample found positive for scrapie and confirmed positive at the DFVF reference laboratory, should be sent to VLA for further molecular typing to determine, whether this sample is infected with scrapie or BSE. In 2004, a combined total of 6,668 fallen sheep and goats were tested, and all animals were found to be negative for scrapie (Table 10).

Table 9. Serotype distribution (%) of prion protein genotype of sheep randomly selected, 2004.

Genotype	Sheep n=100
ARR/ARR	20.0
ARR/AHQ	3.0
ARR/ARH	3.0
ARR/ARQ	15.0
ARR/VRQ	1.0
AHQ/AHQ	1.0
AHQ/ARQ	5.0
ARH/ARH	1.0
ARH/ARQ	1.0
ARQ/ARQ	40.0
ARQ/VRQ	9.0
VRQ/VRQ	1.0
Total	100.0

Source: DFVF

Table 8. BSE surveillance programme for cattle, 2004.

Active surveillance	N	Positive
Healthy slaughtered animals (<30 mo.)	246,591	0
Risk categories:		
Emergency slaugthers (>24 mo.)	1,834	0
Slaughterhouse ante-mortem inspection revealed suspicion or signs of disease (>24 mo.)	9	0
Fallen stock (>24 mo.)	37,658	1
Animals imported from UK	3	0
Animals from herds under restriction	92	0
Passive surveillance		
Animals suspected of having clinical BSE	19	0
TOTAL	286,206	1

Source: DFVA

Table 10. The TSE surveillance programme for sheep and goats, 2004.

Active surveillance	N	Positive
Fallen stock (>18 mo.)	6,547	0
Healthy slaughtered animals (>18 mo.)	117	0
Passive surveillance		
Animals suspected of having clinical TSE	4	0
TOTAL	6,668	0

Source: DFVA

8. Other Zoonoses

An overview of mandatory and non-mandatory notifiable human and animal infections, together with relevant legislation references, can be found in Table A14.

8.1 *Brucella* spp.

Brucellosis is notifiable in animals, but not in humans.

Humans

In 2004, serological testing identified four cases of brucellosis (Table A1). Two cases were found to be positive for *B. abortus* and two positive for both *B. abortus* and *B. melitensis,* one of which was confirmed by culture testing to be *B. melitensis*. No information on travel history was available for these cases.

Cattle

Abortion clusters in cattle are notifiable. Denmark has been officially brucellosis free since 1979. Monitoring is performed by bacteriological examination of abortion material and/or serological analysis of the animal. Bulls are subject to serological testing pre-entry to bovine semen collection centres, and are thereafter, examined annually for brucellosis. No *Brucella* infections were recorded in the 5,312 animals tested in 2004 (Table A9).

Sheep and Goats

Denmark is declared officially brucellosis free in sheep and goats, and ovine and caprine *B. melitensis* has never been detected in Denmark. Monitoring is performed by testing for *Brucella* antibodies in blood samples from sheep and goats, which are submitted as part of a voluntary control programme for lentivirus. In 2004, 4,707 samples from 650 herds were examined and found negative.

Pigs

Boars at porcine semen collection centres are subject to pre-entry serological testing for *Brucella suis*, with follow-up testing at least every 18 months, as well as prior to departure from these centres. In 2004, no *Brucella* infections in were detected in the 34,059 pigs tested (Table A8).

8.2 *Chlamydia psittacci* (Ornithosis)

Ornithosis is notifiable in humans and birds.

Humans

In 2004, eight human cases of ornithosis were reported (Table A1). Six of these patients had caged birds in their home. Two cases were verified by serological testing, 5 cases by PCR assay to detect the presence of *Chlamydia psittaci* and in one case the clinical diagnosis could not be verified.

Birds

At the DFVF all domesticated birds submitted to the laboratory are screened for ornithosis. In 2004, a total of 19 birds were found positive for *C. psittaci*, of which 9 were parakeets, 6 parrots, and 4 budgerigars.

8.3 *Leptospira*

Leptospirosis is notifiable in humans and animals.

Humans

In 2004, there were 33 human cases of leptospirosis, which were all diagnosed by serology (Table A1). All patients recovered. *L. interrogans* ichterohaemorrhagiae accounted for almost half of these infections, but other serovars, including sejrø, patoc, saxkøbing, hurstbridge, bratislava, ballum, and poi, were also observed. The number of reported cases was higher than in past years. Nineteen cases, of which 13 were domestically acquired, occurred over a three-month period in the autumn. The majority of these patients had directly or indirectly been exposed to rat urine.

Pigs

Suspicion of *leptospirosis* in pigs is often based on increased incidence of abortions or other reproductive problems in a herd. In 2004, a total of 303 samples were investigated by immunoflourescence techniques and *Leptospira* were not detected.

8.4 *Mycobacterium bovis/tuberculosis*

Mycobacterium bovis infection is notifiable in both humans and cattle.

Humans

In 2004, two human cases of tuberculosis (TB), caused by *M. bovis,* were reported (Table A1). One case was a young foreigner with abdominal disease; the second was an elderly person suffering from extra pulmonary tuberculosis, believed to be the results of reactivation of the infection.

Cattle

Danish cattle herds have been declared officially tuberculosis free since 1980. Meat inspectors at slaughterhouses perform monitoring for the presence of TB lesions in slaughtered animals and in 2004 no positive cases were observed (Table A9). The last case of TB in cattle was diagnosed in 1988. At semen collection centres, bulls are subject to pre-entry and annual intradermal tuberculin testing.

Deer

Since December 1994, *Mycobacterium bovis* has not been identified in deer in Denmark.

8.5 *Cryptosporidium* spp.

Cryptosporidiosis is not notifiable and therefore, very little information is available concerning the prevalence in humans and animals.

Humans

Two species of *Cryptosporidium*, the zoonotic species *C. parvum* and the anthroponotic species *C. hominis,* are responsible for the majority of human infections. However, several other species have been shown to infect humans as well. To date, *C. parvum* and *C. hominis* infections have been detected in Denmark in addition to a few cases of cryptosporidiosis caused by *C. meleagridis*. However, the human incidence is unknown. At most diagnostic laboratories in Denmark, only patients with persistent diarrhoea or a history of recent travel are routinely examined for cryptosporidiosis. In 2004, 30 cases were reported (Table A1). Previous surveys have shown that approx. 80% of the diagnosed cases are acquired from travel abroad. Studies are ongoing to investigate the species distribution, routes of transmission, risk factors, and potential correlation between genotype and pathogenicity of *Cryptosporidium* found in the Danish population.

Mammals

At present, there are 13 valid species of *Cryptosporidium*. Of these, the most extensively studied species, *C. parvum,* has a very wide host spectrum, whereas some of the other species appear to be more host-specific. Currently, *Cryptosporidium* genotyping is not offered as a routine diagnostic tool in Denmark, but has been carried out as part of ongoing research projects.

Mammalian samples for all age groups, submitted to the DFVF for routine parasitological analysis, were screened for *Cryptosporidium* using immunofluorescence detection and/or a modified Ziehl Neelsen technique. In 2004, 1,367 faecal samples from mammals were analysed. Of the bovine samples, 19.9% were positive for *Cryptosporidium* (Table A9). This is an increase of 3.9% compared to 2003. Of samples from dogs and cats with chronic diarrhoea, 14.8% and 2.3%, respectively, were positive for *Cryptosporidium* (Table A13). Among samples from other animal species submitted to DFVF for diagnose the occurrence of *Cryptosporidium* did not exceed 2%.

Ongoing epidemiological studies in livestock from Denmark have revealed *Cryptosporidium* herd prevalences of 98% in cattle and 100% in pigs. The highest within herd prevalence, 62% and 74% respectively, were detected in young (< 1 month) and weaning (8-30 kg) calves. A study of risk factors is in progress, and so far demonstrated significant associations with farm size and hygiene level. Thus, the larger farms and the less hygienic, the more oocysts are excreted, and therefore more parasitic infection. In Danish cattle herds, several *Cryptosporidium* genotypes have been identified. Of these, the zoonotic species *C. parvum* is more prevalent in young calves, whereas other more host specific genotypes predominate in older cattle. In the study, examination of pig herds observed both *C. suis* and *C. parvum* pig genotype II. These species are regarded as potential zoonotic agents.

The high density of livestock in certain regions of Denmark, the high prevalence and the presence of various zoonotic species and genotypes in both cattle and pig herds, suggest that these farm animals constitute a major reservoir of *Cryptosporidium*. This gives rise to further questions concerning transmission routes under Danish conditions.

8.6 *Echinococcus granulosus/ multilocularis*

Echinococcus granulosus/multilocularis is notifiable in animals but not in humans.

Humans

The incidence of human e*chinococcosis* is unknown in Denmark. In 2004, 9 cases were reported (Table

A1). One case was infected with *E. multilocularis* and 8 cases with *E. granulosus*. *E. granulosus* has never been found in Denmark, hence the infections are believed to be acquired abroad.

Animals

Surveillance for *E. granulosus* is performed as part of the routine meat inspection at the slaughterhouse. There were no findings in 2004. Six foxes were tested for *E. multilocularis* at the DFVF in 2004; none were positive.

8.7 *Toxoplasma gondii*

Toxoplasma gondii infection is not notifiable in Denmark, and the incidence of toxoplasmosis in humans is unknown. However, Denmark has a nationwide neonatal screening system for congenital toxoplasmosis. In 2004, 66,820 newborns were tested, 9 were positive (Table A1).

8.8 *Trichinella*

Trichinella spp. infection is notifiable in animals, but not in humans. In Denmark, infections have not been reported in domestic animals since 1930.

Humans

The incidence of human trichinellosis in Denmark is unknown. Nine cases were reported in 2004 (Table A1). All cases are believed to be acquired abroad or by consumption of private-imported meat.

Pigs

All pigs slaughtered in Denmark for export are examined for *Trichinella*. In 2004, 24,945,030 meat samples from pigs were tested; none were positive (Table A8). Mandatory testing of slaughtered wild boars, confirmed no positive cases among the 1,141 animals examined.

Horses

All horses slaughtered for export are screened for *Trichinella*. In 2004, 1,278 horses were tested, none were positive.

8.9 *Lyssa virus* (Rabies)

Rabies is notifiable in humans and animals.

Humans

No human cases of rabies were reported in 2004 (Table A1), however, 11 people underwent prophylactic treatment after being bitten by a bat. Only one of these attacking bats was examined and found negative for rabies. In addition, 73 people were treated by prophylactic vaccination following exposure abroad to bites from animals suspected of being infected.

Animals

The classic sylvatic rabies virus, namely lyssa virus type 1, has never been reported in Denmark, nor has it been reported from closely surrounding areas for a many years. It is, however, endemic in Greenland, where arctic foxes transmit the disease to sledge dogs and other animals.

Bat monitoring for the European Bat Lyssa virus (EBL) is performed according to Rule no. 432 of 09/06/2004, and this virus has been detected in the Danish bat population. In 2004, 18 wild bats submitted to the DFVF for EBL testing were found to be negative for the virus. One dog and 2 foxes were also examined and found negative.

Antimicrobial resistance

For information on antimicrobial resistance in zoonotic bacteria please refer to the annual report "DANMAP - Consumption of antimicrobial agents and occurrence of antimicrobial resistance in bacteria from food animals, food and humans in Denmark". The 2004 DANMAP report will be available at the end of June 2005 from the following site: www.dfvf.dk, or can be ordered from the Danish Zoonosis Centre (dzc@dzc.dk).

Appendix

Demographic data

Area of Denmark 44,000 sq km

Human population

Age group (years)	Male	Female	Total
0-4	167,882	160,174	328,056
5-14	353,941	336,149	690,090
15-24	304,314	292,809	597,123
25-44	782,066	763,490	1,545,556
45-64	721,842	716,235	1,438,077
> 65	347,247	465,256	812,503
TOTAL	2,677,292	2,734,113	5,411,405

Source: The statistical Yearbook 2004, Danmarks Statistik

Average number of herds, livestock and animals slaughtered in Denmark, 2004.

	Herds	Livestock	Number slaughtered
Broilers	385	21,927,907	130,521,865
Cattle	32,412	1,734,501	592,305
Goats	2,632	19,598	2,620
Horses			2,268
Laying hens excl. barnyard	334	4,032,492	872,634
Pigs	18,483	13,251,064	25,197,000
Sheep & lambs	10,617	200,762	82,051
Turkeys	50	490,930	52,126

Source: The Central Husbandry Register and DVFA

No. of farms in the broiler production and the table-egg production in 2004.

Broiler production	No. of farms	No. of houses	No. of animals, estimated capacity
Central rearing	21	53	400,000
Adult breeders	49	54	1,000,000
Hatcheries	7		
Broilers	310	744	21,000,000
Table-egg production			
Central rearing	7	8	300,000
Adult breeders	7	8	500,000
Hatcheries	5		
Pullet-rearing	101	163	1,500.000
Layers, excl. barnyard sale	276	408	3,600,000

Source: DVFA and DPC

Data tables

Table A1. Zoonoses in humans, number of cases over a ten year period.

Zoonotic pathogen	Incidence per 100,000 2004	Registered no. of cases 2004	2003	2002	2001	2000	1999	1995
Bacteria								
Brucella abortus/melitensis [a]	0.1	4	14	16	18	-	-	-
Campylobacter coli/jejuni [b]	68.8	3,724	3,542	4,378	4,620	4,386	4,164	2,601
Leptospira spp. [b]	0.6	33	13	13	6	21	23	23
Listeria monocytogenes [b]	0.8	41	29	28	38	39	44	29
Mycobacterium bovis [b]	<0.1	2	1	2	4	12	2	9
Chlamydia psittaci [b]	0.1	8	14	13	9	31	31	22
Salmonella spp. [b]	28.4	1,538	1,713	2,071	2,918	2,308	3,268	3,654
S. Enteritidis[b]	10.1	546	737	1,104	1,416	1,182	2,025	2,070
S. Typhimurium[b]	8.6	467	450	378	589	436	584	848
Other serotypes[b]	9.7	525	526	589	913	690	659	736
VTEC total[b]	3.1	168	128	141	92	60	51	2
O157[b]	0.9	47	27	23	24	18	10	2
other	2.2	121	101	118	68	42	41	0
Yersinia enterocolitica [b]	4.2	227	245	240	286	265	339	779
Parasites								
Cryptosporidium spp. [a]	0.6	30	58	38	84	-	-	-
E. multilocularis/granulosus [a,c]	0.2	9	-	-	-	-	-	-
Toxoplasma gondii [a,d]	-	9	-	-	-	-	-	-
Trichinella spp. [a,c]	-	0	9	-	-	-	-	-
Viruses								
Rabies [b]	0	0	-	-	-	-	-	-

[a]Non-notifiable.
[b]Notifiable.
[c]Cases were attributed to travel or consumption of private-imported food
[d]Nation-wide neonatal screening for congenital toxoplasmosis; 66,820 newborns tested in 2004.
Source: SSI

Table A2, Phagetype distrubution (%) of S. Enteritidis from humans, animals, carcasses and imported meat, 2004.

	Human n=546	Pork[b] n=1	Layers[d] n=5	Broilers[e] n=4	Imported Chicken[f] n=59
PT4	23.4	0.0	0.0	0.0	50.8
PT8	20.9	0.0	40.0	0.0	1.7
PT1	13.7	0.0	0.0	0.0	1.7
PT21	11.4	0.0	0.0	0.0	30.5
PT6	6.2	0.0	20.0	60.0	1.7
PT6a	2.7	0.0	0.0	0.0	0.0
PT14b	2.4	0.0	0.0	0.0	0.0
PT13	0.9	0.0	0.0	0.0	0.0
PT11	0.7	0.0	0.0	0.0	0.0
PT2	0.7	0.0	0.0	0.0	0.0
PT21b	0.7	0.0	0.0	0.0	0.0
PT6b	0.7	0.0	0.0	0.0	0.0
NT	5.3	0.0	0.0	0.0	5.1
Other	10.1	100.0	40.0	40.0	8.5
Total	100.0	100.0	100.0	100.0	100.0

Footnotes: see table A3.
Other phagetyped S. Enteritidis isolates: 1 pork isolate (PT other), 2 imported ducks isolates (PT NT), 1 imported turkey isolate (PT4),
Source: DVFA, DFVF and SSI

Appendix

Table A3. Serotype distribution (%) of Salmonella *from humans, animals, carcasses and imported meat, 2004. In some cases more than one serotype was found per positive herd/carcass/batch.Therefore the number of typed units may be greater than the number of positive herds/carcass/batches.*

		Pig		Cattle					Imported meat[f]				
	Human	Herds[a]	Pork[b]	Herds[c]	Beef[b]	Layers[d]	Broilers[e]	Ducks[e]	Pork	Beef	Chicken	Turkey	Duck
	n=1,538	n=922	n=280	n=65	n=38	n=5	n=66	n=163	n=152	n=7	n=147	n=81	n=69
S. Enteritidis	35.5	0.1	0.4	0.0	0.0	60.0	6.1	0.0	0.0	0.0	40.1	1.2	2.9
S. Typhimurium	30.4	70.0	34.3	36.9	11.4	20.0	19.7	0.0	42.1	14.3	8.8	23.5	52.2
S. Virchow	2.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. Newport	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
S. Stanley	2.3	0.2	0.0	0.0	0.0	0.0	7.6	0.0	0.0	0.0	0.0	0.0	0.0
S. Infantis	2.1	3.5	5.7	0.0	0.0	20.0	27.3	0.0	10.5	0.0	7.5	0.0	1.4
S. Dublin	1.8	0.0	0.0	55.4	65.7	0.0	0.0	0.0	0.0	14.3	0.0	0.0	0.0
S. Uganda	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. Kentucky	1.2	0.1	0.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.7	3.7	0.0
S. Saintpaul	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	6.2	5.8
S. Agona	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	12.2	18.5	2.9
S. Derby	1.0	18.4	22.1	0.0	0.0	0.0	1.5	0.0	7.2	0.0	0.0	4.9	0.0
S. Hadar	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.4	2.0	8.6	0.0
S. Bovis-morbificans	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
S. Thomson	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
S. Montevideo	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. 4,5,12:i:-	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0
S. Corvalis	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. Braenderup	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S. Heidelberg	0.5	0.1	0.4	0.0	0.0	0.0	3.0	0.0	0.0	0.0	1.4	1.2	0.0
NT	0.0	1.2	17.1	0.0	17.1	0.0	3.0	8.0	3.3	0.0	2.0	1.2	5.8
Other	11.3	6.2	20.0	7.7	5.7	0.0	25.8	90.8	36.2	0.0	24.5	28.4	29.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Isolates obtained from sampling in pig herds placed in level 2 and 3.
[b]Representative swab samples of pork and beef carcasses from the surveillance programme at slaughterhouses.
[c]Cattle herds examined on clinical indications. The data are not representative for the Danish cattle population.
[d]Represenative samples from the surveillance programme in prodution flocks.
[e]Representative faecal or sock samples from the mandatory AM inspection prior to slaughter
[f]Monitoring of imported meat and meat products.
Source: DVFA, DFVF and SSI

Table A4. Phagetype distrubution (%) of S. Typhimurium from humans, animals, carcasses and imported meat, 2004.

		Pig		Cattle	Broiler	Imported meat[f]			
	Human	herds[a]	Pork[b]	herds[c]	flocks[e]	Pork	Chicken	Turkey	Duck
	n=467	n=685	n=96	n=26	n=13	n=64	n=13	n=19	n=36
DT12	17.7	25.1	25.0	19.2	38.5	7.8	0.0	31.6	0.0
DT120	16.0	13.4	7.3	3.8	15.4	15.6	0.0	0.0	0.0
DT104	9.8	6.9	7.3	15.4	7.7	10.9	61.5	31.6	0.0
DT170	4.7	11.5	10.4	7.7	7.7	1.6	0.0	0.0	0.0
DT193	3.8	4.7	4.2	3.8	0.0	9.4	0.0	0.0	0.0
DT208	3.8	1.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0
DTu302	3.8	1.5	1.0	0.0	0.0	9.4	0.0	0.0	0.0
DT44	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DT40	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DT41	1.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
DT135	1.3	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0
DT85	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NT	0.0	3.5	9.4	0.0	0.0	18.8	0.0	5.3	0.0
Other	33.2	32.1	32.3	50.0	30.8	25.0	38.5	31.6	100.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Footnotes: See Table A3.
Other phagetyped S. Typhimurium isolates: 4 beef isolates (DT99), 1 imported beef isolate (DT104)
Source: DFVA, DFVF and SSI

Table A5. Occurrence of Salmonella *in the table-egg production, 2004.*

Zoonotic pathogen	Central rearing N=9 Positive flocks	Adult breeding N=9 Positive flocks	Pullet-rearing N=368 Positive flocks	Table-egg production N=641 Positive flocks
S. Enteritidis	-	-	1	2
S. Typhimurium	2	-	-	1
Other serotypes	-	-	-	1
Mix-Elisa (S.E./S.Tm.)	-	-	-	1
TOTAL	2	0	1	5

Source: DVFA

Table A6. Occurrence of Salmonella *and* Campylobacter *in the broiler production, 2004.*

Zoonotic pathogen	Adult breeders Flocks N	Positive	Broiler flocks Flocks N	Positive	Slaughterhouse Batches N	Positive	Non-heat treated broiler meat Samples N	Positive
Salmonella spp.								
Danish	155	6	4,313	66	1,472	24	-	-
S. Enteritidis	-	-	-	4	-	-	-	-
S. Typhimurium	-	3	-	13	-	-	-	-
Other serotypes	-	3	-	49	-	-	-	-
Imported	-	-	-	-	-	-	834a	156
TOTAL	155	6	4,313	66	1,472	24	834[a]	156
Campylobacter spp.								
Danish	-	-	5,159	1,391	1,601	286	584	137
Imported	-	-	-	-	-	-	395	204
TOTAL	-	-	5,159[b]	1,391	-	-	979[c]	341

[a]Import control.
[b]Flocks investigated by cloacal swabs collected at slaughter.
[c]Centrally co-ordinated projects
Source: DPC and DVFA

Table A7. Occurrence of Salmonella *and* Campylobacter *in the turkey production, 2004. From March 2004 turkeys were no longer slaughtered in Denmark, hence very few examined flocks.*

Zoonotic patogen	Flock level Flocks N	Positive	Slaughterhouse Batches N	Positive	Non-heat treated turkey meat Samples N	Positive
Salmonella spp.						
Danish	16	0	16	2	-	-
Imported	-	-	-	-	957	82
TOTAL	16[a]	0	16	2	957[b]	82
Campylobacter spp.						
Danish	-	-	-	-	7	0
Imported	-	-	-	-	115	68
TOTAL	-	-	-	-	122	68

[a]Flocks monitored by sock samples 2-3 weeks prior to slaughter and by end-product samples after slaughter.
[b]Import control.
Source: DPC and DVFA

Appendix

Table A8. Occurrence of zoonotic pathogens in pigs and pork, 2004.

	Herds			Slaughterhouse		Non-heat treated pork cuts and products	
Zoonotic pathogen	Herds N	Herds Positive	Animals N	Samples N	% Positive	Samples N	Positive
Bacteria							
Salmonella spp.							
Danish	13,752	519	572,037	33,890		-	-
S. Typhimurium	-	-	-	-	0.47	-	-
S. Derby	-	-	-	-	0.30	-	-
Other serotypes	-	-	-	-	0.56	-	-
Imported	-	-	-	-	-	1,049	87
TOTAL	13,752[a]	519	572,037	33,890[b]	1.33	1,049[c]	87
Campylobacter spp.							
C. jejuni	-	2	-	-	-	-	-
C. coli	-	149	-	-	-	-	-
C. lari	-	0	-	-	-	-	-
Other serotypes	-	1	-	-	-	-	-
TOTAL	191	152	191[d]	-	-	-	-
Brucella abortus	1,268	0	34,059[e]	-	-	-	-
Mycobacterium bovis	-	0	25,197,000[f]	4	0	-	-
Yersinia enterocolitica	576	60	576[d]	-	-	-	-
Parasites							
Trichinella spp.	-	0	24,945,030[g]	-	-	-	-

[a]Herds monitored using serological testing. Herds belonging to level 2 and 3 were defined as *Salmonella* positive.
[b]Swabs from three areas of the half-carcass were collected at the slaughterhouse. Samples from 5 animals were pooled, except at slaughterhouses where 50 pigs or less were slaughtered per month, in which case samples were analysed separately.
[c]Import control.
[d]Caecal content was tested from one animal per herd; collected at the slaughter house (DANMAP programme).
[e]Boars were examined at pre-entry and prior to release from semen collection centres.
[f]Slaughtered pigs were examined by slaughterhouse meat inspectors.
[g]Pigs slaughtered at export slaughterhouses were examined.
Source: DVFA and DFVF

Table A9. Occurrence of zoonotic pathogens in cattle and beef, 2004.

	Herds			Slaughterhouse		Non-heat treated beef cuts and products	
Zoonotic pathogen	Herds N	Herds Positive	Animals N	Samples N	% Positive	Samples N	Positive
Bacteria							
Salmonella spp.							
Danish	221		221	10,695		-	-
S. Typhimurium	-	5	-	-	0.1	-	-
S. Dublin	-	2	-	-	0.3	-	-
Other serotypes	-	1	-	-	0.1	-	-
Imported	-	-	-	-	-	860	7
TOTAL	221	8	221[a]	10,695[b]	0.5	860[c]	7
Campylobacter spp.							
C. jejuni	-	42	-	-	-	-	-
C. coli	-	1	-	-	-	-	-
Other serotypes	-	0	-	-	-	96	0
TOTAL	67	43	67[a]	-	-	96[d]	0
Brucella abortus	848	0	5,312[e]	-	-	-	-
VTEC 0157	251	21	251[a]	-	-	-	-
Mycobacterium bovis	-	0	592,305[f]	-	-	-	-
Parasites							
Cryptosporidium spp.		224	1,123[g]				

[a]Caecal content was tested from one animal per herd, collected at slaughter (DANMAP programme).
[b]Swabs from three areas of the half-carcass were collected at the slaughterhouse. Samples from 5 animals were pooled, except at slaughterhouses slaughtering 5o or less animals per month where samples are analysed individually.
[c]Import control.
[d]Samples of minced beef. A centrally co-ordinated project.
[e]Bulls were examined upon admission to semen collection centres, and annually hereafter.
[f]Slaughtered cattle were examined by the slaughterhouse meat inspectors.
[g]Data from an ongoing research project.
Source: DVFA and DFVF

Table A10. Number of Salmonella *positive batches obtained from imported meat, 2004.*

	Batches examined	Batches positive	Positive for DT104
Poultry	453	109	8
Pork	228	65	7
Beef	230	3	1
Veal	8	0	0
Other	24	2	0
TOTAL	935	179	16

Source: DVFA

Table A11. Control of Salmonella *in compound feeds, feed processing and feed materials in 2004.*

	2004 Samples N	Positive	2003 Samples N	Positive	2002 Samples N	Positive
Feed processing plants (process control):						
Ordinary inspections[a]	2,008	30	2,409	34	2,740	33
Additional inspections	156	21	241	46	262	48
Feed materials, farm animals[b]	1,117	49	144	2	269	5
Transport vehicles, hygiene samples[c]	317	3	-	-	-	-

[a] Recorded serotypes: S. Havana (3), S. Infantis (2), S. Livingstone (2), S. Oranienburg,(1) S. Putten (4), S. Tennessee (3), S. 4.12:b:- (2), S. Mbandaka (2), S.Typhimurium DT 41 (1), S. Meleagridis (2), S. Rissen (1), S. Agona (2), S. Idikan (2), S. Derby (1), S. Bere (1), S. Cubana (1).

[b] Recorded serotypes: S. Rissen (4), S. Infantis (9), S. Livingstone (3), S. Kentucky (5), S. Agona (7), S. Lexington var. 15+ (1), S. Mbandaka (1), S. Senftenberg (7),S. Bredeney (1), S. IIIb 43 :r :e, n, z15, z16 (1), S. Lexington (2), S. Tennessee (2), S. Cubana (1), S. Kintambo (1), S. Llandoff (1), S. Montevideo (1), S. Ouakam (1), S. 4.12:b:- (1).

[c] Recorded serotypes: S. Indiana (1), S. Meleagridis (1), S. Senftenberg (1).

Source: PD

Table A12. Serotype distribution (%) of Salmonella *from rendering plants, 2004.*

Serotype	Samples n=164
S . Adelaide	0.6
S . Cubana	1.8
S . Derby	0.6
S . Infantis	12.8
S . Kentucky	1.2
S . Lille	0.6
S . Livingstone	14.6
S . Llandoff	1.2
S . Montevideo	54.3
S . Parathyphi-B var. Java	0.6
S . Putten	0.6
S . ru. ikke typbar	3.1
S . senftenberg	3.1
S . Thyphimurium	0.6
S . 4:12:b:-	3.1
Not typable	1.2
TOTAL	100.0

Source: DVFA

Appendix

Table A13. Occurrence of zoonotic pathogens in pets, zoo animals and wildlife, 2004.

	Pet animals						Zoo animals		Wild animals									
	Dog		Cat		Others				Hare		Ruminants		Fox		Other		Water fowl	
Zoonotic pathogen	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive
Bacteria																		
Salmonella spp.																		
S. Enteritidis	-		-		-		-	2	-		-		-		-	5	-	
S. Typhimurium	-		-		-		-	0	-		-		-	2	-	1	-	
Others	-		-		-	2	-	8	-		-		-		-		-	
TOTAL	45	0	6	0	43	2[a]	221	10[b]	35	0	35	0	22	2	67	6[c]	10	0
Campylobacter spp.																		
C. jejuni	-		-	1	-		-	2	-		-		-		-		-	
C. coli	-		-		-		-		-		-		-		-		-	
C. upsaliensis	-	3	-	3	-		-		-		-		-		-		-	
Others	-		-		-		-	8	-		-		-		-		-	
TOTAL	7	3	8	4	4	0	20	10	-		-		-		1	0	-	
Parasite																		
Cryptosporidia spp.	81	12	41	1	-		-		-		-		-		-		-	

[a]Hogislandboa: S 1.40:Z4:Z24:-; Leopard turtle: S. Adelaid
[b]Camelion: S. IIIb21:1,V:Z; Crested Screamer: S. Seftenberg; Frilled dragon: S.58:-:-; Green Iguana: S. IV 16:Z4,Z32:-; 2 Leopard Geckos: S. Fluten, S II 30:1. Z 28:Z6; Tigerpython: S. Enteritidis; 3 Turtles: S. Enteritidis; S. London, S. 9.12:-:-; .
[c]Hedgehog
Source: DFVF

Surveillance programmes

Table A14. Overview of human and animal notifiable and non-notifiable diseases (reported herein) in Denmark, 2004, with reference to the relevant legislation.

	Notifiable in humans	Notification route	Notifiable in animals	EU legislation	Danish legislation
BACTERIA					
Brucella spp.	no	-	yes	Cattle - Decision 2000/69/EEC Sheep and goats - Decision 94/877/EEC Pigs - Directive 2003/99/EEC	Rule no. 432 of 09/06/2004
Campylobacter spp.	yes[a]	Lab[b]	no		
Chlamydophila psittaci (Ornithosis)	yes[a]	Physician[c]	yes		Birds - Rule no. 432 of 09/06/2004
Listeria monocytogenes	yes[a]	Physician	no		
Leptospira spp.	yes[a]	Physician	yes		Rule no. 432 of 09/06/2004
Mycobacterium bovis/ tuberculosis	yes[a]	Physician and (lab[d])	yes	Cattle - Decisions 2000/69/EEC, 2000/442/EEC, 2000/694/EEC	Bovine - Rule no. 432 of 09/06/2004
Salmonella spp.	yes[a]	Lab	no		
VTEC	yes[a]	Lab	no		
Yersinia enterocolitica	yes[a]	Lab	no		
PARASITES					
Cryptosporidium spp.	no	-	no		
Echinococcus spp.	no	-	yes		Rule no. 432 of 09/06/2004
Toxoplasma gondii	no	-	no		
Trichinella spp.	no	-	yes	Pigs - Directive 64/433/EEC	Rule no. 432 of 09/06/2004
VIRUSES					
Lyssa virus (Rabies)	yes[a]	Telephone and physician	yes		Rule no. 432 of 09/06/2004
PRIONS					
TSE	-		yes	Sheep & goats - Regulation 999/2001 (as amended)	Order no. 1093 of 12/12/2003
BSE	-		yes	Cattle - Regulation 999/2001 (as amended)	Order no. 1528 of 20/12/2004
BSE/Creutzfeld Jacob	yes[a]	Physician			

[a]Danish order no. 277 of 14/04/2000.
[b]The regional microbiological laboratories report confirmed cases.
[c]The physician report individually notifiable infections.
[d]The laboratories voluntarily report confirmed cases.
Source: DVFA and SSI

Appendix

Table A15. Salmonella *surveillance of the broiler and table-egg production, 2004.*

Broiler and Table egg production

Central-rearing flocks		*Grandparent generation*	*Parent generation*
Time	Sample taking	Material	Material
Day-old	Per delivery	10 samples of crate material and 20 dead chicks[a]	10 samples of crate material and 20 dead chicks [a]
1st week	Per unit[g]	-	40 chicks
2nd week	Per unit	-	2 pairs of sock samples
4th week	Per unit	60 faecal samples[a]	60 faecal samples[a]
8th week	Per unit	2 pairs of sock samples	2 pairs of sock samples
2 weeks prior to moving	Per unit	60 faecal samples[a]	2 pairs of sock samples [a] and 60 blood samples
Adult breeding flocks		*Grandparent generation*	*Parent generation*
Time	Sample taking	Material	Material
Every two weeks	Per flock	250 meconium samples or 50 dead chickens collected at the hatchery[a,b]	250 meconium samples or 50 dead chickens collected at the hatchery[a,b]
Every week	Per unit	-	2 pairs of sock samples[c]
Hatchery		*Grandparent generation*	*Parent generation*
Time	Sample taking	Material	Material
After each hatching	Samples from1-4 hatchers may be pooled	At least 25 grams of wet dust per hatcher	At least 25 grams of wet dust per hatcher

Broiler production

Time	Samples taken	Material
2-3 weeks before slaughter - Ante mortem (AM)	Per flock	5 pairs of sock samples
After slaughter Post mortem (PM)	Per batch	AM-negative batches: 4 pooled samples of 10 chicken cuts[d] AM-positive batches: 12 pooled samples of 5 chicken cuts[d]

Table egg production

Pullet-rearing flocks

Time	Sample taking	Material
Day-old	Per delivery	10 samples of crate material and 20 dead chicks
Week 3	Per flock	5 pairs of sock samples or 300 faecal samples, if sock samples cannot be collected. Flocks of less than 200 birds: 2 pairs of sock samples or 60 faecal samples
Week 12	Per flock	Flocks of 500 or more birds: 60 blood samples and 5 pairs of sock samples or 300 faecal samples of sock samples cannot be collected[e] Flocks of 200-499 birds: 55 blood samples and 5 pairs of sock sample[e] Flocks of less than 200 birds: Blood samples[f] and 2 pairs of sock samples or 60 faecal samples[e]

Production for certified packing stations

Time	Sample taking	Material
Every 9 weeks	Per flock	Egg samples[f] and 2 pairs of sock samples or faecal samples, equal to the number of eggs, if sock samples cannot be collected

Barnyard and hobby flocks

Time	Sample taking	Material
3 times a year	Per flock	Egg samples[f]

[a]Requirements of the Zoonosis Directive (92/117/EEC)
[b]Samples collected by the RVFCA every 8 weeks
[c]Samples collected by the RVFCA every 3 month
[d]Requirements of the Commission Regulation (92/1538EEC)
[e]Samples collected by the RVFCA
[f]According to Table 1 in Governmental Order No. 44, Jan 23rd 2003
[g]A unit (house) may harbour part of a flock or more than one flock, depending on the size of the unit.
Source: DVFA

Table A16. Salmonella *surveillance of the pig production, 2004.*

Breeding- and multiplier herds		
Time	Sample taken	Purpose
Every month	10 bloodsamples per epidemiological unit	Calculation of salmonella-index
Salmonella-index 5 or above, max. twice per year	Pen-faecal samples	Clarify distribution and type of infection in the herd
Sow-herds		
Time	Sample taken	Purpose
When purchaser of piglets is assigned to level 2 or 3, max. twice per year	Pen-faecal samples	Clarify distribution and type of infection in the herd
Slaughter-pig herds		
Time	Sample taken	Purpose
At slaughter	Meat juice, 60-100 samples per herd per year	Calculation of slaughter-pig index. Assigning herds to level 1-3
Herds assigned to level 2 or 3, max. twice per year	Pen-faecal samples	Clarify distribution and type of infection in the herd

Source: DVFA

Table A17. Salmonella Dublin *surveillance of the cattle production*[a]*, 2004.*

Milk producing herds		
Time	Sample taken	Validity[b]
Every 3 month	Tank milk samples, taken by the dairy.	12 months.
Non-milk producing herds		
Time	Sample taken	Validity[c]
The interval between 2 samples must be at least 21 days and no more than 5 months	Bloods samples, taken at the slaughterhouse.[d]	Herds with at least 25 animals: Blood samples are valid for 4 months. Herds with less than 25 animals: Blood samles are valid for 12 months

[a]Sampling is voluntary. Herds not sampled are given status unknown.
[b]A herd must have 4 valid samples to get a status.
[c]A herd must have 3 valid samples to get a status.
[d]If no animals are slaughtered, the samples may be taken by a veterinarian.
Source: DVFA

Notes

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