MINISTRY OF FAMILY
AND CONSUMER AFFAIRS
Danish Institute for Food
and Veterinary Research

Annual Report on Zoonoses in Denmark 2005

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Zoonoses in Denmark 2005

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This is an official publication from the Danish Zoonosis Centre, the Danish Veterinary and Food Administration and the Statens Serum Institut.

Suggested citation:
Anonymous, 2006. Annual Report on Zoonoses in Denmark 2005, the Ministry of Family and Consumer Affairs, Copenhagen, Denmark.

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Layout: Susanne Carlsson
Printing: Frederiksberg Bogtrykkeri A/S
ISSN 0909-4172

The report is also available at:
www.dfvf.dk

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 2005. The report is based on data compiled according to the zoonoses directive 03/99/EEC, supplemented by data obtained from national surveillance and control programmes and data from relevant research projects provided by institutions contributing to the report. Occasionally corrections to the data may occur after publication, why some data may be subject to minor changes in the following years report. The report is also available at www.dfvf.dk.

The report is divided into a general chapter describing the surveillance of zoonotic agents and outbreak investigations in Denmark followed by chapters on the individual zoonotic agents. The majority of the tables is located in the Appendix, while figures are included in the appropriate chapters. An overview of current surveillance programmes, including sample schemes and references to the relevant legislation is presented in the Appendix.

Profile of the year

In 2005, the number of human *Salmonella* infections increased for the first time since 2001 to approximately the same level as in 2003. A total of 1,775 cases were reported representing a 15% increase compared to 2004. The increase was primarily attributed to an 18% increase in the number of *S.* Enteritidis cases and a 20% increase in the number of *S.* Typhimurium cases. The increase in the number of human *Salmonella* cases is mainly explained by an increased number of cases attributable to Danish produced food, particularly pork (9-15% of cases) and table eggs (7-11% of cases). Overall, 30% of all *Salmonella* cases were attributed to Danish produced food of animal origin, whereas 19% were associated with the consumption of imported meat and meat products. Twenty-four percent of *Salmonella* cases were estimated to be travel related. The remaining approximately 27% of cases could not be associated with any source.

The number of human *Campylobacter* cases remained at the same level as in 2004. A total of 3,671 cases was reported. The prevalence of *Campylobacter* in the broiler flocks increased slightly from 27% in 2004 to 30% in 2005. It is still however a significant decrease compared to the years prior to the implementation of the volutary intervention strategy. Consumption and handling of fresh poultry is believed to be the major source of human campylobacteriosis in Denmark, though other sources also exist.

Outbreaks

Outbreaks with *Campylobacter* are remarkably rare. In 2005, an outbreak involving 58 patients was reported, which is the largest reported foodborne *Campylobacter* outbreak to date. Another outbreak of 66 cases caused by *Cryptosporidium hominis* was the first outbreak in Denmark registered outside a hospital setting. As in previous years, *Salmonella* was the bacterial agent responsible for most outbreaks. One outbreak involving 40 patients was caused by imported beef contaminated with multi-drug resistant *S.* Typhimurium DT104. The beef was used for carpaccio at a restaurant.

A new database for the registration of food- and waterborne outbreaks was introduced in Denmark towards the end of 2005. This database replaced the different parallel reporting systems for outbreaks that have been in place in previous years.

Surveillance

In July 2005, the surveillance system for slaugterpig herds was changed into a riskbased surveillance, where the sample size in herds with no positive serological meat-juice samples in the previous 5 month is reduced to one sample per month. Overviews of the different surveillance programmes are presented in the Appendix Tables A14-A17.

1. Surveillance and outbreak investigations

1.1 Surveillance of human diseases

Described in this report, are the Danish occurrence of 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), *Echinococcus, Leptospira, Listeria, Mycobacterium*, BSE prions (var. Creutzfeldt-Jakob Disease), Lyssavirus (rabies), as well as non-notifiable zoonotic pathogens: *Brucella, Cryptosporidium, Toxoplasma,* and *Trichinella*. An overview of the notifiable and not notifiable human diseases with reference to the relevant legislation is provided in Table A14.

In Denmark, the physicians report individually notifiable zoonotic diseases to Department of Epidemiology at the Statens Serum Institut (SSI) (Figure 1). Positive cases diagnosed by a clinical microbiological laboratory are reported through the laboratory surveillance system to the Unit of Gastrointestinal Infections at the 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. Furthermore, all *Salmonella* isolates are sent to the reference laboratory at the SSI for further typing. The results are recorded in the Register of Enteric Pathogens maintained by the SSI. Positive cases are recorded as episodes, i.e. each person-infectious agent combination is only registered once in a six-month period.

1.2 Outbreaks of zoonotic gastrointestinal infections

In Denmark, local foodborne outbreaks are typically investigated by the Regional Veterinary and Food Control Authority (RVFCA) in collaboration with the medical officer; often also with the participation

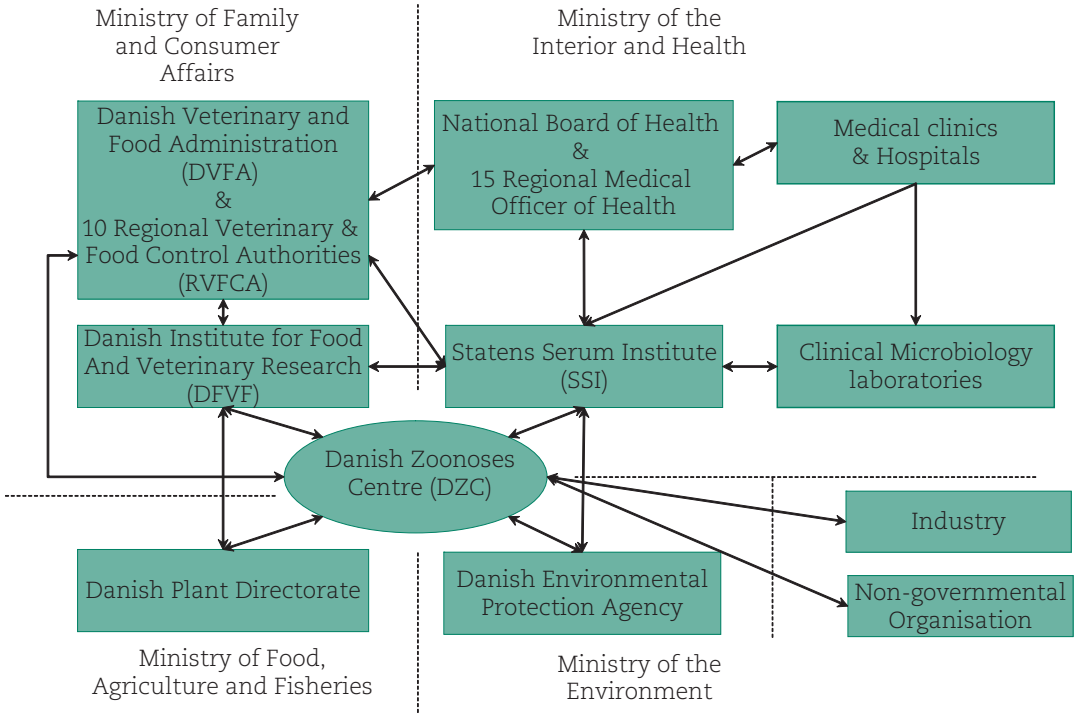


Figure 1. Overview of the monitoring and outbreak investigation network for reporting infectious pathogens in humans, animals and feedstuffs in Denmark. The DZC is a part of the DFVF, but activities are co-ordinated by a body of representatives from all four ministries.

of the regional clinical laboratory. Larger outbreaks involving more than one region are typically investigated by the SSI, the Danish Institute for Food and Veterinary Research (DFVF) and the Danish Food and Veterinary Administration (DVFA). These institutions may also aid in the investigation of local outbreaks. The Danish Zoonosis Centre (DZC) co-ordinates the collaboration between the DFVF, the SSI and the DVFA. Representatives from these institutions meet regularly to discuss surveillance results and compare the occurrence of zoonotic agents in animals, food and feedstuffs with that in humans (Figure 1). The formal responsibility of investigating food- or waterborne outbreaks is currently divided between three ministries based on the outbreak source: the Ministry for the Interior and Health for infectious diseases; the Ministry of Family and Consumer Affairs for food and animal related diseases; and the Ministry of the Environment for water related diseases.

Outbreaks may be discovered in various ways including the following: Individuals who experience illness related to food intake in settings such as restaurants or work place cantinas may report these incidents directly to the RVFCA. Physicians are obligated to report all suspect foodborne infections to the regional medical officer, and to the SSI. Clusters of cases may be noted in the laboratory or identified at the SSI through the laboratory surveillance system of gastrointestinal bacterial infections or though subtyping of bacterial isolates from patients.

A new database for the registration of food- and waterborne outbreaks (FUD) was introduced towards the end of 2005 (see box below), and all outbreaks occurring in 2005 were entered (most of them retrospectively) into this database. Based on these data, Table 1 lists the outbreaks investigated in 2005 and Table 2 compiles outbreaks that were notified but not investigated to the extent that provided reliable detailed information. Household outbreaks (in which all patients had the same address) are not included, but listed in the footnote.

Several of the outbreaks were notable. Even though campylobacteriosis is the most frequently occurring bacterial zoonosis in Denmark, outbreaks with *Campylobacter* are remarkably rare and the outbreak listed in Table 1 (FUD no. 451) involving 58 patients is the largest foodborne *Campylobacter* outbreak reported to date in Denmark. It occurred in early summer in a series of companies in the Copenhagen area which all used the same lunch-caterer. A cohort study among employees identified chicken salad served on a specific date as the source. Subsequent investigations revealed that raw pieces of chicken breasts stored on an upper shelf in a refrigerator resulted in cross-contamination of fried chicken pieces stored on shelves beneath.

A second outbreak, which also occurred during summer in a large company in the Copenhagen area, was caused by *Cryptosporidium hominis* (FUD no. 414). Outbreaks with this parasite are very rarely reported in Denmark and this is the first recorded outbreak outside of a hospital setting. Two analytical epidemiological studies were conducted among the employees identifying food from the company canteen as the

Foodborne Outbreak Database (FUD) – A database for the registration of food- and waterborne outbreaks

A new database for the registration of food- and waterborne outbreaks was introduced in Denmark towards the end of 2005. This database replaces the different parallel reporting systems for outbreaks that have been in place in previous years. The new system is accessible to registered users via the Internet. It is open to all professionals working with foodborne outbreaks such as the food control authority staff and the medical officers. The investigators can enter information about outbreaks and their ongoing investigation, eventually leading to a full outbreak report. In addition, the system is designed to capture outbreak notifications, i.e. initial reporting of verified or suspected outbreaks, thus hopefully helping to alert other investigators and leading to more outbreaks being noted, recognised and investigated.

Table 1. Foodborne disease outbreaks[1] registered in the Foodborne Outbreak Database (FUD), 2005.

Pathogen	No. of patients	Patients laboratory confirmed	Setting	Suspected source	Database no.
Bacillus cereus	16	0	Restaurant	Pizza	533
Bacillus cereus	21	0	Restaurant	Buffet meal	535
Bacillus cereus	4	0	Restaurant	Sliced chicken	537
Campylobacter	10	2	Hotel	Unknown	429
Campylobacter	58	4	Company canteen	Chicken salad	451
Clostridium	11	0	Canteen	Composite meal	437
Clostridium perfringens	58	3	School	Beef	416
Clostridium perfringens	27	0	Catering, private party	Buffet meals	564
Clostridium perfringens	9	0	Restaurant, private party	Pork	586
Clostridium perfringens	15	0	Catering, company	Beef	589
Cryptosporidium	99	12	Canteen	Carrots	414
Salmonella	10	1	Institution	Unknown	440
S . Goldcoast	8	4	Unknown	Unknown	422
S . Heidelberg	6	6	Shop	Beef/Pork	464
S . Poona	7	7	Private home	Unknown	442
S . Typhimurium, DT12	25	25	Other	Pork	361
S . Typhimurium, DT104	40	31	Restaurant	Beef, carpaccio	411
S . Typhimurium, DT193	21	21	Butcher shop	Pork?	417
S . Typhimurium, DT104	7	7	Unknown	Unknown	436
S . Typhimurium, DT193	9	8	Meat sold in retail	Beef	432
S . Typhimurium	3	2	Private home	Unknown	496
S . Typhimurium, RDNC	5	5	Slaughterhouse	Pork	558
S . Typhimurium, RDNC	7	5	Butcher shop	Pork	583
Norovirus	141	7	Hotel	Buffet meals	424
Norovirus	84	0	Canteen	Buffet meals	425
Norovirus	27	3	Restaurant	Buffet meals	426
Norovirus	80	0	Canteen	Buffet meals	434
Norovirus	34	0	Canteen	Buffet meals	435
Norovirus	450	24	Hospital	Frozen Raspberries	457
Norovirus	70	0	Home for elderly	Frozen Raspberries	458
Norovirus	400	15	Meals-on-weels	Frozen Raspberries	459
Norovirus	37	4	Restaurant	Frozen Raspberries	460
Norovirus	50	9	Home for elderly	Frozen Raspberries	461
Norovirus	34	3	Company canteen	Frozen Raspberries	462
Norovirus	21	0	Restaurant	Unknown	471
Norovirus	40	0	Restaurant, private party	Buffet meals	590
Histamin	7	0	Restaurant	Fish, butterfish	538
Wax esters	5	0	Restaurant	Fish, escolar	542
TOTAL	1847	193			

[1] In addition 6 confirmed household outbreaks were registered. These were cause by S. Enteritidis (2 outbreaks), S. Typhimurium (2), Campylobacter (1) and ETEC (1).
Source: SSI, DVFA, RVFCA

source. About 100 patients met the case-definition and the majority of those fell ill one week after the assumed exposure. The epidemiological studies pointed towards intake of carrots and other salad bar ingredients, as the source of the outbreak, but the pathogen was not found in any food (more than one week passed between exposure and discovery of the outbreak). Carrots were kept in a large bowl of water and it was speculated that a human carrier using the salad bar contaminated the water.

As in previous years *Salmonella* was the bacterial agent responsible for most outbreaks, and S. Typhimurium outbreaks were detected more frequently than outbreaks caused by S. Enteritidis. This is partly explained by the more extensive subtyping of S. Typhimurium. S. Typhimurium isolates were routinely real-time subtyped by MLVA[1)], PFGE[2)], phage typing, and antimicrobial resistance profiling, whereas S. Enteritidis was analysed using phagetyping alone.

[1)] MLVA: Multiple Locus Variable number of tandem repeats Analysis, the method was described in Annual Report 2004
[2)] PFGE: Pulse Field Gel Electrophoresis

Table 2. Possible outbreaks[1] with a suspected food source registered in the Foodborne Outbreak Database (FUD), 2005.

Pathogen	No. of events	No. of patients	Patients laboratory confirmed	Setting	Suspected source
Campylobacter	12	52	14	Restaurants, private homes	Chicken, turkey, unknown
S. Enteritidis	1	4	1	unknown	Unknown
S. Typhimurium	5	14	6	Restaurants, private homes, hospital	Composite meals, unknown
Yersinia enterocolitica	1	2	1	Institution	Unknown
Other agents	4	29	0	Restaurants	Fish, composite meals
Unknown agents	12	66	0	Restaurants, private homes, canteens	Buffet meals, composite meals, chicken, unknown
TOTAL	35	167	22		

[1] In addition 26 non-verified household outbreaks were registered. These were caused by S. Enteritidis (4 outbreaks), other *Salmonella* serotypes (3), *Campylobacter* (7) and other or unknown agents (12).
Source: SSI, DVFA, RVFCA

In one outbreak (FUD no. 411), use of contaminated imported beef for carpaccio (raw marinated beef) during a period of 6 weeks in a single restaurant resulted in a large number of cases with multi-drug resistant S. Typhimurium DT104 infection. In a second outbreak caused by S. Typhimurium DT12 occurred predominantly on the island of Funen (FUD no. 361). In this outbreak comparison of isolates obtained from the *Salmonella*-surveillance at farm level and at slaughterhouses identified a specific local slaughterhouse and a limited number of pig herds as the likely source of the outbreak. In both outbreaks typing by MLVA played an important role in detecting and pointing at the possible source of the outbreaks.

A series of six norovirus outbreaks received much attention in 2005 and were all caused by imported frozen raspberries (Table 1). This was determined with a high degree of confidence by virus detection and epidemiological analyses including several analytical epidemiological studies.

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 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, the RVFCA or the DFVF. Results are reported in central databases and made available for all involved stakeholders including the DVFA, the DFVF and the industry (Figure 1, section 1.1). In addition, *Salmonella* isolates are forwarded to the DFVF for subtyping (serotyping, phagetyping and antimicrobial susceptibility testing).

The Danish surveillance programme for multidrug resistant S. Typhimurium DT104 (MRDT104) has been in place since 1998. The programme mandates a zero-tolerance for this pathogen in all foods. Meat imported from 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 at the DFVF or at the slaughterhouse using a PCR detection method.

Pigs and cattle carcasses are screened for *Mycobacterium* and *Echinococcus* during meat inspection at the slaughterhouse. All slaughter pigs slaughtered at export approved slaughterhouses, horses slaughtered for human consumption and wild boars are examined for *Trichinella*.

In addition, boars and bulls are tested for *Brucella* and *Mycobacterium* (only in bulls) 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 non-notifiable zoonoses described in this 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 within its own region, and the DVFA is responsible for the regulation, control strategy and the surveillance at the 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 survey sampling primarily at the retail level. These surveys are focused on collecting samples from high risk products and areas e.g. specific trade facilities or specific types of food establishments. Targeted samples account for 40% of all samples collected,
- Other types of sampling at the food whole sale and retail level account for 30% of all samples collected and 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 food-borne disease,
  - sampling in response to consumer complaints.

Centrally co-ordinated control is carried out as national projects or surveys account for 30% of all samples collected. The purpose of these projects is to:

- Discover emerging problems with microbiological contaminants,
- Generate data for the preparation of risk profiles and risk assessments to support microbial risk management,
- Monitor the effect of established risk management procedures in order to evaluate if these provide the desired results or if they need to be reconsidered.

Table 3 provides information on the centrally co-ordinated projects conducted in 2005. Some projects are described in more detail later in the report. For further information consult DVFA's webpage www.fvst.dk (in Danish). 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.

Table 3. Centrally coordinated studies conducted in 2005.

Title of project	No. of samples	Agents analysis per sample (regional laboratories)	Futher information
Microbiological classification of the production areas for bivalve molluscs	300	*E.coli, Salmonella*	
F-RNA bacteriophages and virus in the production areas for bivalve molluscs	300	F-RNA, virus	
EU co-ordinated control campaign on cheeses made from pasteurised milk	300	*Salmonella, Staphylococcus aureus, E.coli, Listeria*	
EU co-ordinated control campaign on pre-packed ready-to-eat salads containing meat, fish or shellfish	200	*Listeria monocytogenes*	
Campylobacter in fresh, chilled Danish chicken meat	1800	*Campylobacter*	Section 3.2
Campylobacter in fresh, chilled imported chicken meat and frozen Danish chicken meat	1500	*Campylobacter*	Section 3.2
Campylobacter in fresh, chilled turkey meat	600	*Campylobacter*	Section 3.2
Campylobacter in fresh, chilled Danish chicken meat before and after treatment with steam	1000	*Campylobacter*	
Antimicrobial resistance in foods	1000	*E. coli, Enterococcus*	
Antimicrobial resistance in Danish and imported poultry meat	1000	*Salmonella, Campylobacter, E. coli, Enterococcus*	
VTEC in cattle	500	*E. coli* O26, O103, O111, O145, O157	Section 6.2
VTEC in beef and veal	500	VTEC	Section 6.2
Reduction of *E. coli* O157 in beef during cold storage	300	*E. coli* O157	
E. coli O157 in pigs	300	*E. coli* O157	Section 6.3
Salmonella Dublin in offals	600	*Salmonella* Dublin	
Listeria monocytogenes and *Bacillus cereus* in milk and cream	600	*Listeria monocytogenes, Bacillus cereus*	
VTEC in imported meat	600	*E. coli* O26, O103, O111, O145, O157	

Source: DVFA, DFVF

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 years three distinct waves of salmonellosis related to the consumption of broiler meat (peaking in 1988), pork (peaking in 1994) and table eggs (peaking in 1997) were observed. Since 1997, a steadily decreasing trend has been seen (Figure 2). This reduction in the incidence of human cases is to a large extent 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 2005, 1,775 laboratory-confirmed episodes of salmonellosis were reported corresponding to 33 cases per 100,000 inhabitants (Table A1). This is almost the same number of infections as in 2003, but represents an increase of 15% compared to 2004.

In 2005, there were 642 reported episodes of *S. Enteritidis* corresponding to an incidence of 11.9 per 100,000 (Table A1). This represents an 18% increase compared to 2004, but a 12% decrease compared to 2003. Figure 3 shows the geographical distribution of *S. Enteritidis* cases. A total of 604 isolates was phage typed and the most common phage types were PT8 (29.8%), PT4 (14.9%), PT21 (14.1%), PT1 (11.6%) and PT14b (4.1%) (Table A2).

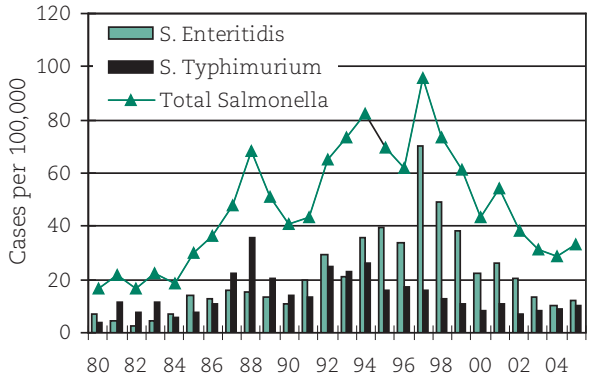


Figure 2. Reported cases of human salmonellosis in Denmark. 1980-2005.
Source: SSI

There were 565 reported episodes of *S. Typhimurium* corresponding to an incidence of 10.4 per 100,000 inhabitants (Table A1). This is a 21.0% increase compared to 2004 and a 46.9% increase compared to 2002, where the lowest number of human *S. Typhimurium* cases recorded during the last 20 years was observed. Figure 4 shows the geographical distribution of *S. Typhimurium* cases. The distribution of phage types (DT) is presented in Table A3, with the most common types being DT104 (22.9%), DT120 (15.9%), DT12 (12.7%) and DT193 (8.7%). Unspecified types accounted for 11% of isolates. Multi-drug resistance (i.e. resistance to four or more different classes of antimicrobials)

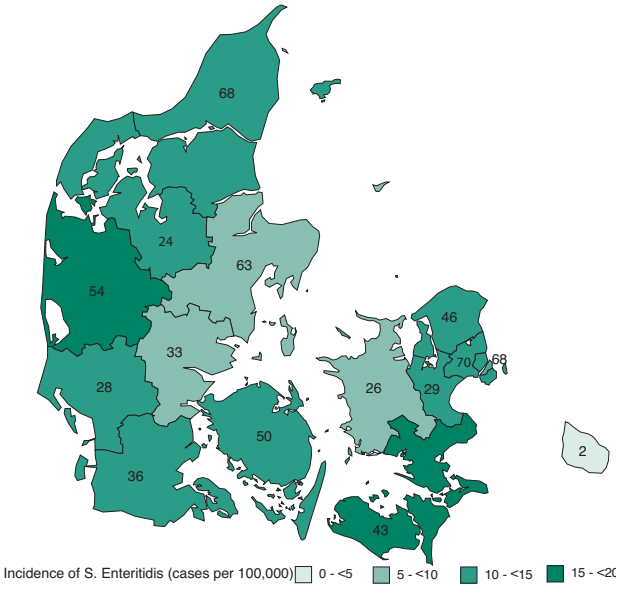


Figure 3. Geographical distribution of the number of cases per county and incidence of human infections with S. Enteritidis, 2005.
Source: SSI

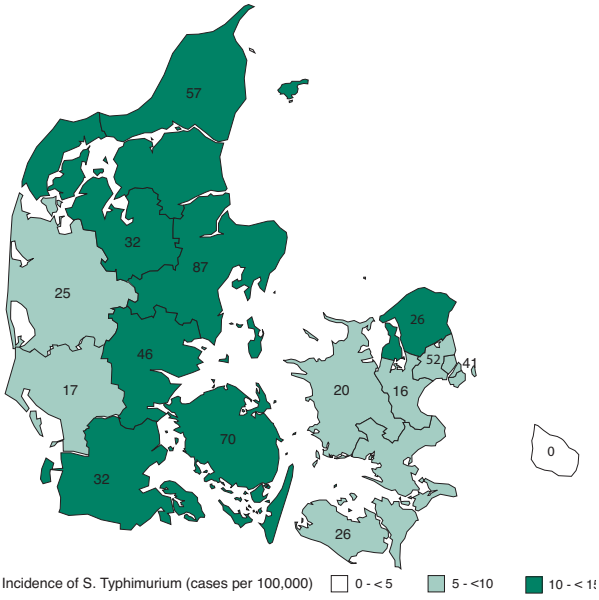


Figure 4. Geographical distribution of the number of cases per county and incidence of human infections with S. Typhimurium, 2005.
Source: SSI

was observed in 43% of isolates, whereas 45% were susceptible to all drugs tested. In 2005, 127 human cases of DT104 and DT104b were reported and 104 (81.9%) of these were caused by multi-drug resistant strains (Figure 5).

Other *Salmonella* serotypes accounted for 568 episodes, an increase of 8% compared to 2004 and corresponding to an incidence of 10.5 per 100,000 inhabitants (Table A1). Of the 106 other serotypes isolated, those most commonly encountered were S. Newport (38 cases), S. Virchow (35 cases), S. Stanley (35 cases), S. Infantis (30 cases), S. Dublin (24 cases), S. Hadar (23 cases), S. Kentucky (22 cases) and S. Agona (18 cases) (Table A4).

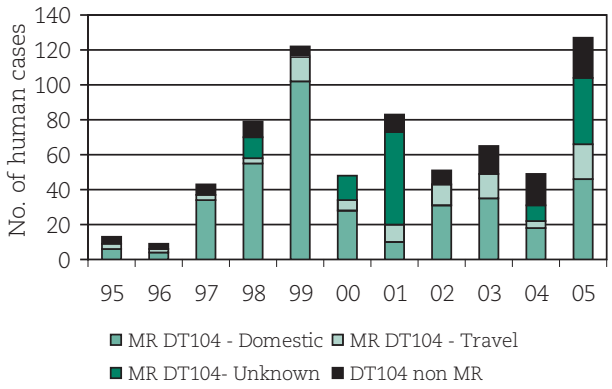


Figure 5. Reported cases of human S. Typhimurium multi-drug resistant DT104 (MR DT104) and non multi-drug resistant DT104 (DT104 non MR), 2005. Both included DT104b.
Source: SSI

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 the 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 the Salmonella types isolated from the various animal-food sources. Resistance profiles of S. Typhimurium isolates were also included to further distinguish between similar phage types found in animals, food and humans.

In 2005, the estimated mean number of human cases (per 100,000 inhabitants) that could be attributed to the various food of animal origin, was as follows: table eggs: 3.9; broilers: 1.3; pork: 4.0; ducks: 0.3; beef: 0.5; imported poultry products: 4.0; imported beef: 1.2; imported pork: 0.8; cases related to outbreaks: 0.5; travel: 7.8 (see comment below); unknown source: 8.3 (Figure 6). The overall increase in the incidence of human salmonellosis observed from 2004 to 2005, can mainly be explained by an increased number of cases associated with domestically produced food,

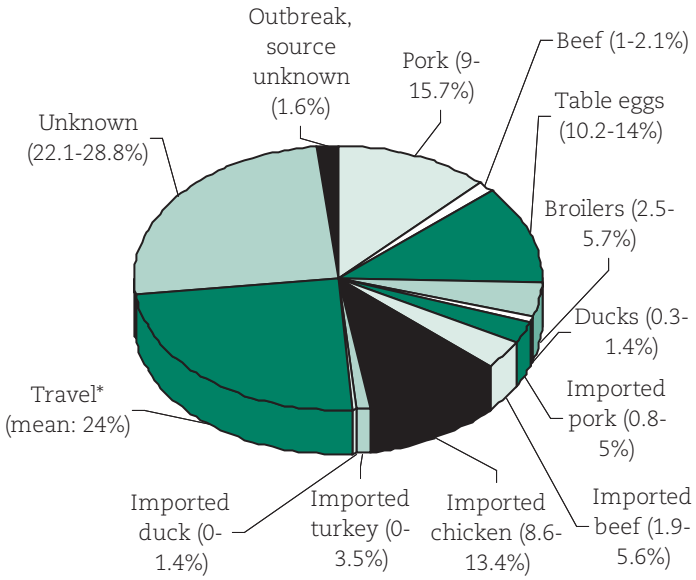


Figure 6. Estimated sources of 1,775 cases of human salmonellosis in Denmark, 2005 (See also Table 4).
* The estimate of travel-associated cases should be interpreted carefully, since data concerning travel history were very poor in 2005.
Source: DZC

particularly pork and table eggs (Table 4). The number of cases attributable to domestic pork includes 38 laboratory-confirmed cases related to an outbreak. The overall number of cases associated with imported food of animal origin remained at the same level as in 2004. However, the number of cases associated with imported beef was more than six times higher. Half of the cases are explained by an outbreak of S. Typhimurium DT104 related to imported beef (see section 1.2). Figure 7 shows the estimated number of cases caused by three major infection sources (broilers, eggs and pork) from 1988 to 2005.

The number of cases reported as travel-related is known to be underreported. Before 2003, 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). However, from 2003 and onwards, this approach proved extremely difficult, since the majority (approximately 70% in 2005) of patients has no travel information. Consequently, the estimate of the total number of travel-associated cases is very uncertain and should be interpreted with care. For 2005, we estimated that approximately 426 (7.8 per 100,000) cases were travel related. Of these, 263 cases had positively reported travelling before disease onset.

Specifically, for the 562 reported S. Typhimurium cases, 54 were estimated to be associated with travelling and 97 were outbreak related. Of the domestically and sporadically occurring cases, 186 were

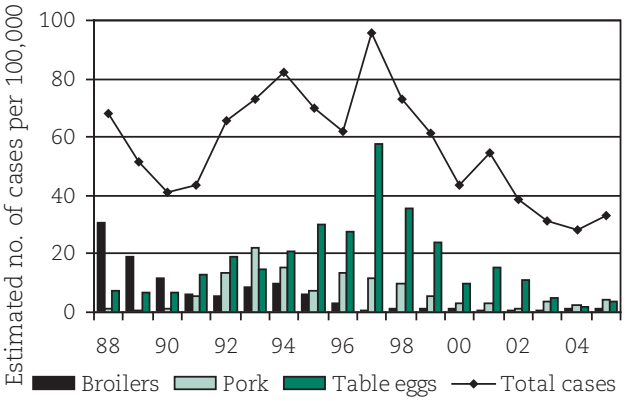


Figure 7. Trends and sources of human salmonellosis in Denmark, 1988-2005.
Source: DZC

associated with Danish produced food and 81 with imported food, whereas the remaining 144 cases had an unknown source of origin. Based on the antimicrobial susceptibility testing, it was estimated that 5% of infections from Danish produced food were multi-drug resistant (resistant to four or more drugs), none were quinolone resistant, 22% resistant (resistant to less than four drugs) and 73% susceptible. In the imported food, 66% were multi-drug resistant, 10% were quinolone resistant, 10% were resistant and 14% were susceptible. Overall, this indicates that around 90% of all multi-drug resistant and/or quinolone resistant S. Typhimurium infections are acquired from food produced outside Denmark i.e. either from imported food or from travelling abroad.

Table 4. Estimated no. of reported human cases (with 95% confidence interval) and percentage of cases per major food source, travel or outbreaks, 2003-2005.

	2005		2004		2003	
Source	Estimated no. of reported cases (95% confidence interval)	Percentage of reported cases	Estimated no. of reported cases (95% confidence interval)	Percentage of reported cases	Estimated no. of reported cases (95% confidence interval)	Percentage of reported cases
Pork	215 (159-278)	12.1	142 (109-175)	9.2	202 (172-235)	11.8
Beef	26 (17-38)	1.5	22 (15-30)	1.4	17 (11-23)	1.0
Table eggs	214 (182-249)	12.1	100 (76-126)	6.5	271 (224-318)	15.8
Broilers	72 (45-101)	4.1	66 (37-101)	4.3	36 (21-54)	2.1
Turkeys					4 (1-12)	0.2
Ducks	13 (6-25)	0.7	11 (3-25)	0.7	24 (14-34)	1.4
Imported pork	45 (15-89)	2.5	98 (68-133)	6.4	13 (2-32)	0.8
Imported beef	66 (34-99)	3.7	10 (6-14)	0.6	48 (29-65)	2.8
Imported poultry					230 (151-321)	13.4
Imported chicken	194 (152-238)	10.9	147 (109-186)	9.6		
Imported turkey	18 (0-62)	1.0	46 (27-66)	3.0		
Imported duck	7 (0-25)	0.4	5 (1-13)	0.4		
Travels[1]	426	24.0	415	27.0	526	30.6
Unknown	451 (392-511)	25.4	425 (368-481)	27.7	271 (264-281)	15.8
Outbreaks, unknown source	28	1.6	51	3.3	74 (66-82)	4.3
TOTAL	1,775	100	1,538	100	1,716	100

[1]Estimates of travel related cases should be interpreted carefully, since availability of travel history data was very poor in 2003-2005.
Source: DZC

Survey of Salmonella *in pasteurised egg*

A survey of *Salmonella* in pasteurised eggs in Denmark was conducted in 2004. The purpose was to evaluate the effectiveness of the pasteurisation process of whole egg and salted egg yolk, and to evaluate the own-check procedures of the industry. In case *Salmonella* was found to survive pasteurisation, an additional objective was to find possible explanations for this, i.e. an extraordinary high load of *Salmonella* in the raw product or flaws in the pasteurisation process, either general or sporadic.

Traditionally, raw eggs are used as an ingredient in many dishes in Denmark. An increased risk of salmonellosis from raw eggs has lead to a public demand for a pasteurised alternative. Pasteurised egg is generally considered a safe product, but risk assessments have shown that there is a risk that *Salmonella* may survive pasteurisation. The pasteurisation procedure is difficult, since the level of heat treatment required for killing *Salmonella* is close to the level where the egg mass coagulates.

The present survey included a total of 294 paired samples of raw and pasteurised eggs from all producers in Denmark. A paired sample was taken from the same batch. The samples were analysed quantitatively for *Salmonella*. High levels of *Salmonella* were observed in the raw egg samples (Figure I). Four of the pasteurised egg samples were positive for S. Enteritidis. All four positive samples were salted egg yolk originating from the same production plant. In all cases the corresponding raw egg bulk samples contained high levels of *Salmonella* (10^5 – 10^6 *Salmonella* per ml).

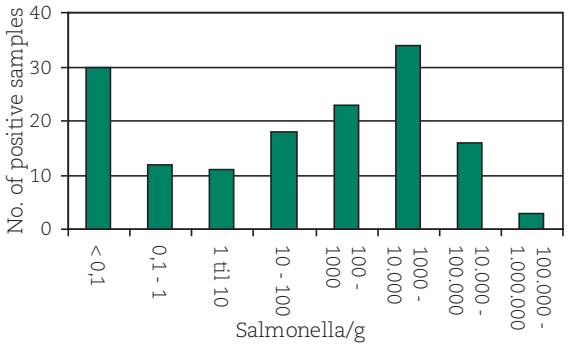


Fig I. Salmonella *spp. in raw egg bulk before pasteurisation, 2004.*
Source: DFVF

Eggs for pasteurisation include eggs produced by *Salmonella* infected flocks, eggs from *Salmonella* free flocks and imported eggs of unknown status. The survey showed that the Danish pasteurisation industry generally meets the demand for safe products irrespective of the origin of the shell eggs. Immediate corrective measures were imposed, i.e. correction of storage temperatures and times along with adjustment of the pasteurisation procedure at the producer where pasteurisation was not efficient.

High levels of *Salmonella* in the raw egg bulk increase the likelihood of *Salmonella* in the final product and in the present study the combination of too high temperature in the cooling storage facility and long-term storage was a likely explanation for the high *Salmonella* content in the raw egg bulk. The pasteurisation conditions, i.e. the temperature and time combination, was apparently insufficient to eliminate the high load of *Salmonella* at one producer. The study underlines the importance of correctly adjusted pasteurisation temperatures and stringent control of storage conditions and times. It also illustrates the fact that presence of salt increases survival of microorganisms. It is evident that in case problems arise, the routine own-check programmes are not always sufficient to reveal these. Improved sensitivity of methods and quantification may be necessary to make errors visible and indeed, to be able to explain why errors occurred.

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 and the sampling scheme is summarised in Table A15. The administration of this programme is performed by the Danish Poultry Council (DPC) under the supervision of 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 are covered by the government. All poultry flocks in the production line are monitored for *Salmonella* as described in Table A15.

Table-egg production

No rearing-breeding or adult breeding flocks were positive for *Salmonella* in 2005. However, 6 pullet-rearing flocks were found positive for S. Enteritidis PT8 during the last quarter of the year. A trace-back investigation was carried out and the likely source of infection was a specific flock producing hatching eggs (Table A5). In flocks producing eggs for egg packing stations, *Salmonella* was found in 1.1% of the total number of flocks examined, compared to 0.8% in 2004, and 2.3% and 2.6% in 2003 and 2002, respectively. A total of 7 flocks were found positive. Three out of 217 free-range flocks were positive for S. Enteritidis PT8, and 4 out of 175 battery flocks were positive. Two were positive for S. Enteritidis PT6, 1 positive for S. Enteritidis PT21 and 1 positive for S. Infantis. A total of 378 barnyard flocks were examined and 0.8% 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 are sold directly from the premises only. Households using eggs from barnyard flocks for own consumption are not obliged to test for *Salmonella*, but may do so voluntarily.

Broiler production

No rearing breeding or adult breeding flocks were positive for *Salmonella* in 2005. In 2005, the monthly percentage of positive flocks ranged from 0.3% to 2.6% with an annual prevalence of 2.1% (Table A6). This was an increase compared to 2004, where 1.5% of the flocks were positive for *Salmonella* (Figure 9). S. Typhimurium was found in 26.2% and S. Infantis in 25.0% of the positive flocks. Sero- and phagetype distributions are presented in Tables A2-A4.

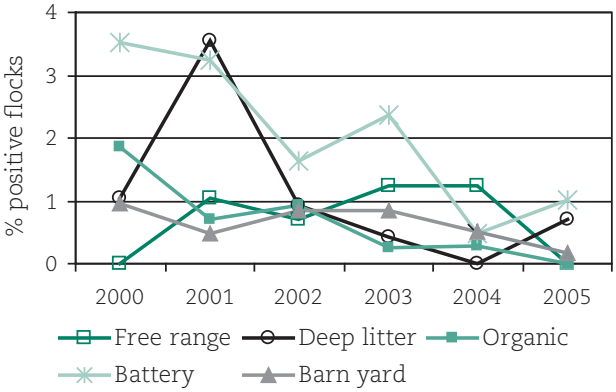


Figure 8. Percent Salmonella *positive table-egg layer flock according to type of production, 2000-2005.*
Source: DVFA

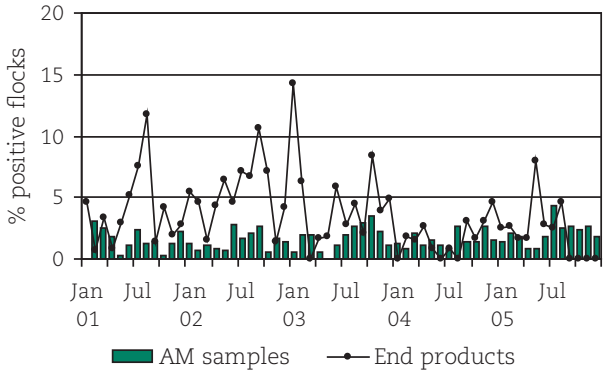


Figure 9. Percent Salmonella *positive broiler flocks detected at the mandatory ante-mortem (AM) and end product examination, 2001-2005.*
Source: DVFA and DPC

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 2.3% of these batches (Figure 9 and Table A6), which is an increase compared to 2004, where 1.6% of the batches were positive. From the middle of the year 2005, the two main producers of poultry meat were approved to market *Salmonella*-free poultry meat. As a part of this approval they were allowed to take verification samples for *Salmonella* once a week instead of following the programme set up in the legislation where samples are taken each day. As a consequence, the overall number of tested batches declined by approximately 20% in 2005. This might account for the increased percentage of positive batches in 2005, since the actual number of positive batches in 2005 was almost the same as in 2004 (27 in 2005 and 24 in 2004). However, from September to December no batches positive for *Salmonella* were observed.

EU Baseline study on the prevalence of Salmonella *in egg-laying flocks*

Background

As a part of the new Zoonosis directive[3] and regulation[4], the Commission wanted to initiate common EU-studies of the *Salmonella* incidence in table-egg layers, broilers and slaughter pigs, so called Baseline Studies. The first study[5] investigating the *Salmonella* prevalence in flocks of table-egg layers was carried out from October 2004 to September 2005. The purpose was to generate comparable prevalence data from all Member States (MS).

Under the order, Denmark was obliged to sample one flock from each of 190 holdings with a minimum of 1,000 hens. However, the DVFA decided that all herds should be sampled to determine the Baseline prevalence in Danish table-egg layers. In total, 257 holdings with a minimum of 1,000 hens were to be sampled. The study ran parallel with the existing surveillance programme.

The veterinary officers from the RVFCA collected the samples from a flock representative of a holding maximum 9 weeks before depopulation. Seven pooled samples from each flock were collected: 5 socks/droppings/mixed faeces from dropping belts, and 2 samples of dust material. If a sample was found positive, the holding was considered positive for the purpose of this study. To be considered positive in accordance with the existing surveillance programme, a flock suspected of being infected must be retested (i.e. suspect sampling) in order to confirm the infection. All samples were analysed at the DFVF. One isolate from each positive sample was serotyped, and samples positive for S. Typhimurium and S. Enteritidis were also phagetyped. Further, testing of anti-microbial susceptibility was performed on one isolate per serotype per flock. A proportion of the isolates were sent to the Community Reference Laboratory (CRL) in the Netherlands for quality assurance. All data from the analyses were registered in the database at The Danish Poultry Council.

Results

Out of the 257 holdings, 221 (86%) were sampled during the study period, the remaining 34 holdings were sampled at a later stage. Ten flocks (4.5%) were found positive. Three of the flocks were already known to be positive through the existing surveillance programme. The remaining 7 flocks found positive in the baseline study were also considered suspected of infection through the existing surveillance programme. Five of the flocks were depopulated before confirmatory sampling could be performed, one flock was tested positive at the confirmatory sampling, and one flock was tested negative.

Five of the 7 holdings had a history of *Salmonella* infection; 4 holdings with the same serotype as detected in this study and 1 holding had been infected 3 times with 2 different serotypes. When an infection is verified at a holding the facility must be cleaned, disinfected and tested negative before new flocks can be introduced. However, it cannot be excluded that the infection persists in the surrounding environment or in the house at a very low level.

Future

Based on the national reports sent to the European Food Safety Authority, the Commission will establish the EU-targets for *Salmonella* reduction in flocks of table-egg layers. These targets will be minimum targets, and will be accompanied by guidelines for the sampling methods to be used. The DVFA awaits the report, after which a revision of the existing surveillance programme will be considered.

[3] Directive 2003/99/EC
[4] Regulation 2160/2003/EC
[5] Commission Decision 2004/665/EC

Turkey production

Since 2004, turkeys are not slaughtered commercially in Denmark, as the only major turkey slaughterhouse closed. Most turkeys raised in Denmark are hereafter transported abroad for slaughter. In 2005, 22 flocks were tested for *Salmonella* and all found negative (Table A7).

Duck production

Duck flocks were monitored by the mandatory ante-mortem (AM) examination prior to slaughter. In 2005, 242 flocks were examined. *Salmonella* was isolated from 179 (74%) of the flocks. In several cases, more than one serotype was isolated from each flock. *S.* Regent (25.3%), *S.* Kottbus (21.2%), *S.* Indiana (20.8%) and *S.* Anatum (18.0%) were the most frequently isolated serotypes in the infected flocks (Table A4).

2.4 Pig 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 2002, the Danish Bacon and Meat Council (DBMC) has carried out the daily administration, under the supervision of the DVFA. 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 samples is carried out in herds producing more than 200 slaughter pigs per year (11,676 herds in December 2005). Each month, a serological slaughter pig index (SP-index) is calculated for each herd, based on the proportion of seropositive meat juice samples from the last three months. The index gives more weight to the results from the most recent month (1:1:3). The SP-index serve to assign the slaughter pig herds to one of three infection levels:

- Herds in Level 1 have none or only a small proportion of positive samples,
- Herds in Level 2 have a higher proportion of positive samples,
- Herds in Level 3 have an unacceptably high proportion of positive samples.

In July 2005, the surveillance system was changed into a riskbased surveillance, following which the sample size in herds with a SP-index of zero (no positive samples the previous 5 months) was reduced to one sample per month. This change reduced the annual sample size from approximately 570,000 meat juice samples in 2004 to approximately 400,000 in 2005. 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 *Salmonella* infection. Furthermore, the producers are paid a reduced price per animal from these herds. Pigs from herds in Level 3 must be slaughtered under special hygienic precautions. In 2005, only minor fluctuations were observed in the number of herds in Level 2 and 3, and by the end of the year, 3.2 % and 0.9% of the herds were assigned to Level 2 and 3, respectively (Figure 10).

Sow herds supplying piglets to slaughter-pig herds in Level 2 or 3 are obligated to collect pen-faecal samples to identify the *Salmonella* type and to clarify possible transmission of *Salmonella* from sow herds to slaughter-pig herds.

Each of the 200 Danish breeding and multiplying pig herds are monitored monthly through serological testing of 10 randomly collected blood samples from pigs 4-7 months of age. Each month, a serological breeder- and multiplier index (BM-index) is calculated for each herd, based on the mean serological reaction from the last three months. The index gives more weight to the results from the more recent months (1:3:6). If the BM-index exceeds 5, it is mandatory to collect pen-faecal samples for *Salmonella* analysis (Table A16) and the herd owner must inform buyers of breeding animals about the infection level and *Salmonella* type in the herd.

An increase in the number of breeding and multiplying herds exceeding this threshold was observed from 2001 to 2003; it peaked at more than 15% in 2004

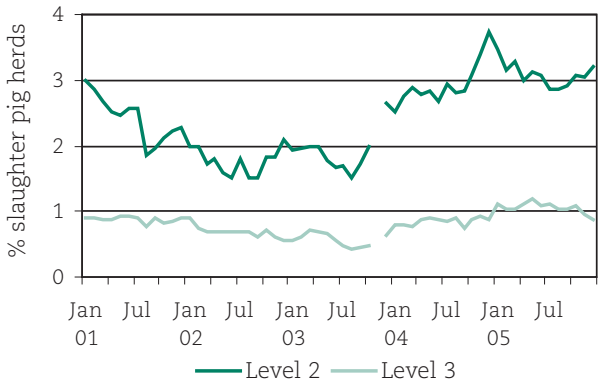


Figure 10. Serological surveillance of Salmonella *in slaughter-pig herds. Percentage of herds in level 2 and 3, 2001-2005. The cut-off level for positive meat juice samples was lowered in August, 2001. The abrupt increase in 2003 was attributed, in part, to analytical-technical adjustments.*
Source: DVFA.

and has been fluctuating around 10% since a decline in May 2004 (Figure 11). This in combination with the stabilised proportion of herds in level 2 and 3 indicates a general stabilisation of the prevalence of *Salmonella* in pig herds in 2005.

Clinical disease in combination with finding of *Salmonella* was recorded in 32 herds (Table 5). This represents the number of herds submitting material from clinically affected animals to the laboratory with findings of *Salmonella*. Six 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 estimating the prevalence of *Salmonella*, both the loss of sensitivity and the probability of more than one sample being positive in each pool were taken into consideration. A conversion factor has been determined on the basis of comparative studies, as described in Annual Report 2001. In 2005, 30,730 swab samples were collected and pooled and the prevalence of *Salmonella* in single swab samples was estimated to be 1.0%. An additional 79 samples were collected from slaughterhouses with a small production and were analysed individually. Of these, one sample was found positive for *Salmonella* (Figure 12 and Table A8). Based on results from the previous 12 months, the moving average has declined from 1.3% in January to 1.0% in December. As 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.

Table 5. Isolation of Salmonella *from outbreaks of clinical disease in pig and cattle herds, 2005.*

Serotype	Pigs herds	Cattle herds
4,12:-:-	2	-
9,12:lv:-	1	-
9,12:-:-	-	1
Anatum	-	1
Derby	4	-
Dublin	-	37
Enteritidis	1	-
Infantis	2	-
Livingstone	1	-
Typhimurium	21	15
Typhimurium MRDT104	-	2
Uganda	-	1
TOTAL	32	57

Source: DVFA

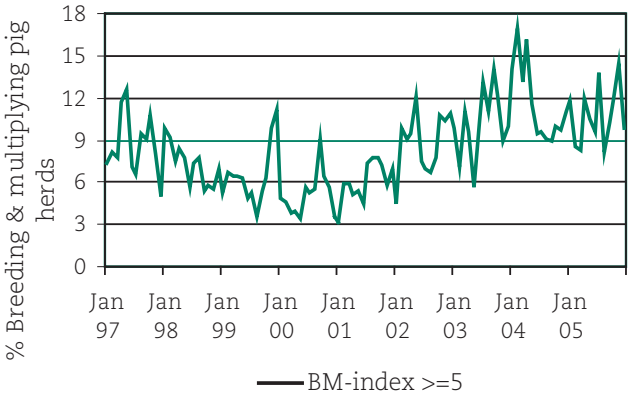


Figure 11. Serological surveillance of Salmonella *in breeding and multiplying pig herds. Percentage of herds with an index >=5, 1997-2005.*
Source: DBMC

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 (Table 6). The herds are assigned to the levels based on serological results from milk and blood samples or on account of contact with a herd assigned to a higher infection level. The S. Dublin surveillance programme was described in the Annual Report 2003 and the sampling scheme is summarised in Table A17.

In December 2005, 18.9% of milk-producing herds were classified into level 2 (Table 6), which is a marginal decrease compared to 2004 where 19.5% of the herds were assigned to level 2.

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

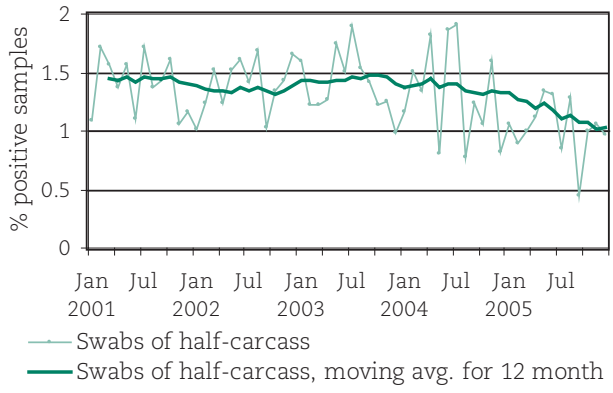


Figure 12. Salmonella *in pork, monitored at slaughterhouses, 2001-2005. Swab samples from 3 designated areas of chilled half carcasses.*
Source: DVFA

Table 6. No. of cattle herds assigned to level 1-3 according to the S. Dublin surveillance, December 2005.

S. Dublin level		Non-milk producing herds		Milk producing herds	
		N	%	N	%
Level 1	Most likely S. Dublin free	10,387	52.8	4,563	80.8
Level 2	S. Dublin is most likely present or status unknown				
	Titer high in blood- or milk samples	532	2.7	898	15.9
	Contact with herds in level 2 or 3	912	4.6	147	2.6
	Other e.g. missing samples	7,818	39.7	20	0.4
	Total	9,262	47.1	1,065	18.9
Level 3	Salmonellosis, official supervision, or the herd owner has purchased animals from a known level 3 herd				
	Hygienic slaughter, off. vet. control	14	0.1	17	0.3
	Other	7	0.0	0	0.0
	Total	21	0.1	17	0.3
TOTAL		19,670	100	5,645	100

Source: DVFA

Clinical disease in combination with the finding of *Salmonella* was recorded in 57 herds (Table 5). Of these, 29 herds were placed under official veterinary supervision, while 7 were subject to hygienic slaughter due to confirmed infections of S. Dublin. Two herds were placed under Zoonosis supervision, the official veterinary supervision, due to finding of multi-drug resistant S. Typhimurium DT104.The program is currently under revision.

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 2005, 9,550 samples were pooled and the prevalence of *Salmonella* was estimated to be 0.6% after using the conversion factor in the same manner as described for pork. An additional 282 samples were collected from slaughterhouses with a smaller production and were analysed individually. Of these, 2 were positive for *Salmonella* (Figure 13 and Table A9). Since 2001, the 12 month moving average has slowly increased from 0.1% to 0.6%. In total, S. Dublin was isolated from 78.1% of the positive samples (Table A4).

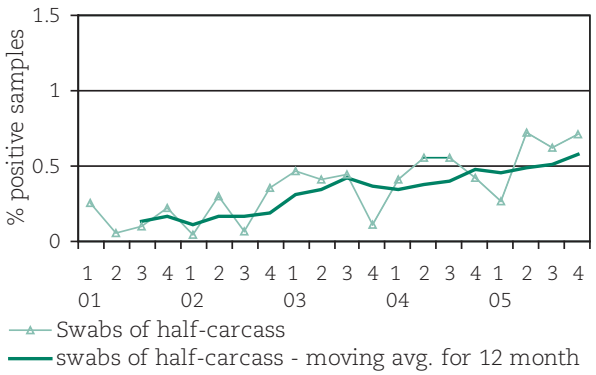
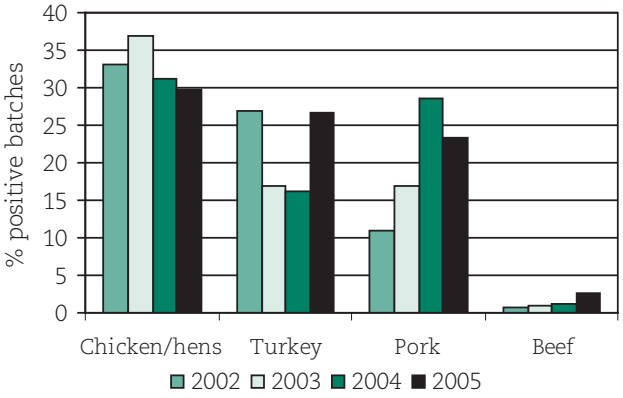


Figure 13. Salmonella *in beef, monitored at slaughterhouses, 2001-2005. Swab samples taken from 3 designated areas of chilled half-carcasses.*
Source: DVFA

2.6 Imported meat and meat products

The surveillance programme for multi-drug resistant S. Typhimurium DT104 (MRDT104) (described in Annual Report 2001) 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 2005, a total of 1,102 batches of imported fresh meat were examined for MRDT104. 1.5% of the batches was positive for MRDT104 compared to 1.7% in 2004. In total, 17.2% of the batches was positive for *Salmonella*, compared to 19.1% in 2004. In chickens/hens, turkeys, pork and beef the number of positive batches was 26.1%, 26.4%, 23.2% and 2.9%, respectively (Table A10, and Figure 14 and 15).



Figur 14. Percent Salmonella *positive batches from the import control, 2002-2005.*
Source: DVFA

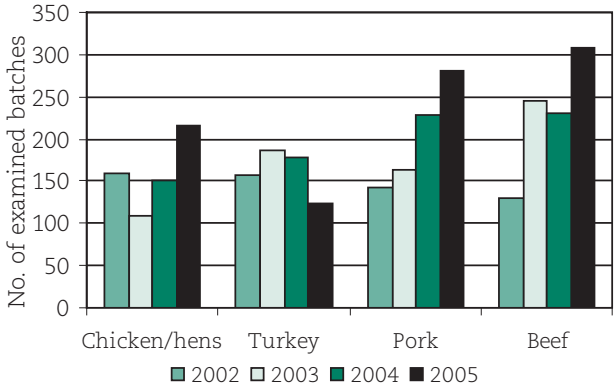


Figure 15. Number of examined batches from the import control, 2002-2005.
Source: DVFA

2.7 Feeding stuff

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

Since 2004, the strategy for controlling *Salmonella* in feeding stuffs has been 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 environ mental samples collected during feed processing,
- Sampling of feed materials increased from 300 samples to 1.000 samples per year and the sampling method was modified,
- Samples from transport vehicles were col lected (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 in 2004, results from 2005 are comparable only with results from 2004 (Table A11).

In 2005, an increase in the number of *Salmonella* positive feed samples from feed materials was observed compared to 2004. This increase is explained by a single batch of feed material with large proportion of positive samples (24 out of 36 samples). If this one sampling is excluded, the prevalence of *Salmonella* in feed materials corresponds to the 2004 level.

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 03/10/2002.

- 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 are by-products from healthy parts of animals and processed at cate gory 3 processing plants. These materials may be used for pet food.

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 2005, 8,825 samples of meat and bone meal were examined for *Salmonella*. Of these, 5,026 were collected as a part of the plants' own-check programmes and the remaining 3,799 samples as controls of the products. In total, 1.1% of the samples were found positive for *Salmonella* and all isolates were serotyped. S. Livingstone and S. Montevideo were the most common serotypes found. S. Enteritidis and S. Typhimurium were not recorded (Table A12).

2.9 Pets, zoo animals and wildlife

A small number of samples from pets, zoo animals and wild life are tested for *Salmonella* at the DFVF. As in previous years, samples from pets were tested on clinical indication only and one dog was found positive for *Salmonella* (Table 13).

Zoo animals examined for *Salmonella* were mainly reptiles and birds, and 5% of these were found positive (Table A13). Hunters, veterinarians and the public submit wild animals to the DFVF and 6.5% were positive (S. Enteritidis was isolated from 15 hedgehogs and S. Typhimurium from 14 finches and one gull).

3. Campylobacter

3.1 Humans

Since 1999, campylobacteriosis has been the leading cause of bacterial gastrointestinal disease in Denmark. In 2005, there were 3,671 reported cases (Table A1), corresponding to an incidence of 68 cases per 100,000 inhabitants (Figure 16). This was roughly the same number of infections as the year before. The incidence of *Campylobacter* in humans has a distinct seasonal distribution, with a summer peak in June-September. 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 17. Outbreaks of human campylobacteriosis are rare, but one large outbreak was recorded in 2005 (see Section 1.2, Table 1).

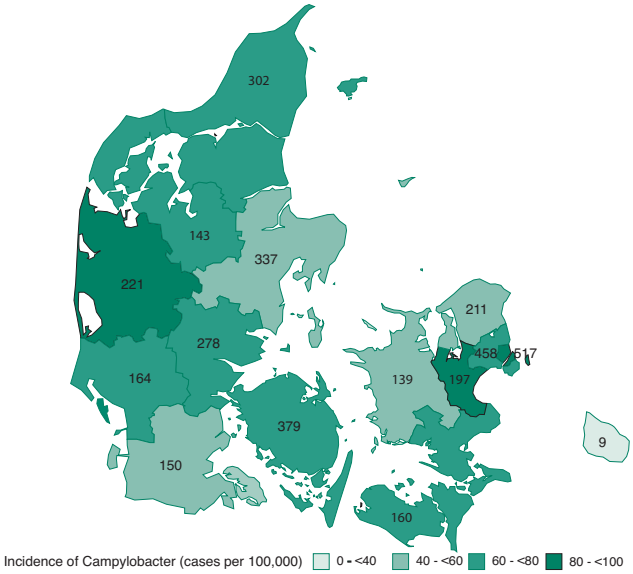


Figure 17. Geographical distribution of the number of cases per county and incidence of human campylobacteriosis, 2005.
Source: SSI

3.2 Poultry

The voluntary intervention strategy aimed at reducing the number of *Campylobacter* positive broiler flocks implemented in 2003 was continued in 2005. The strategy has been described in the Annual Report, 2003. All broiler flocks are sampled for *Campylobacter* at the slaughterhouse prior to slaughter, and the samples are analysed using a PCR detection method.

In 2005, there were 29.9% *Campylobacter* positive flocks (Table A6). This represents a significant decrease compared to the years prior to implementation of the strategy, where the prevalence was greater than 35%, but a slight increase compared to 27% positive flocks in 2004 (Figure 18). As for human campylobacteriosis, the prevalence in broilers has a distinct seasonal variation, with a summer peak in July/August. In 2005, the prevalence of positive broiler flocks per month ranged from 8.8% positive flocks in April to 57.3% in July.

Although samples were collected from the flocks following transport to the slaughterhouse, it is beli-

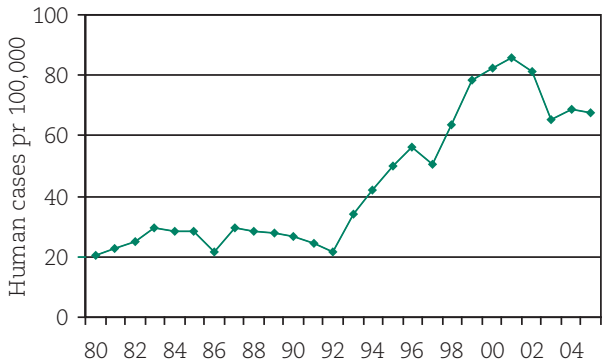


Figure 16. Incidence per 100.000 of human campylobacteriosis in Denmark, 1980-2005.
Source: SSI

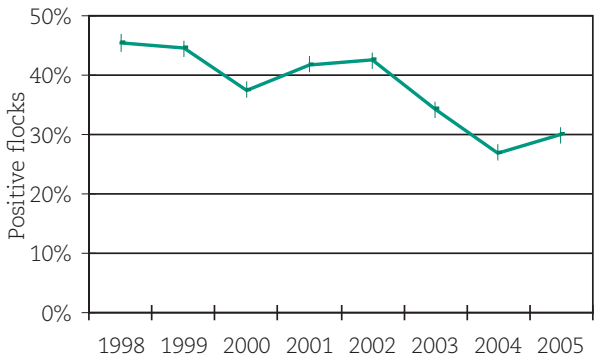


Figure 18. Percentage of broiler flocks infected with Campylobacter, *1998-2005.*
Source: DFVF

eved that the observed prevalence reflects the flock status at the farm. Therefore, the significant reduction in prevalence, compared to the years prior to the implementation of the strategy, 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.

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 and Figure 16). Since 2003 the number of human cases have remained at the same level. The significant decrease observed in 2002-2003 coincided 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* in broilers does not differentiate between species of *Campylobacter*. However, as part of the monitoring programme for the occurrence of antimicrobial resistance in zoonotic bacteria (DANMAP), approximately 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 493 samples investigated, 22.1% were found to be positive for *Campylobacter*. Of these, 90.8% were identified as *C. jejuni*, 2.8% as *C. upsaliensis*, and the remaining 6.4% was atypical.

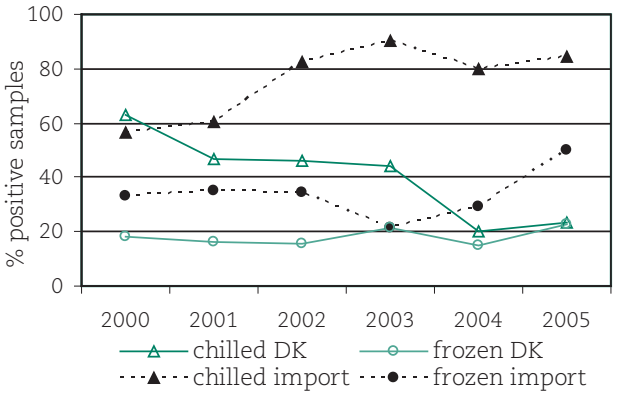


Figure 19. Percent Campylobacter *positive samples from chilled and frozen, Danish and imported chicken meat, 2000-2005.*
Source: DFVF

No flocks of hens, ducks or turkeys were tested for *Campylobacter* in 2005.

As in the preceding years, the prevalence of *Campylobacter* in chilled and frozen fresh poultry meat was monitored in 2005. The samples were taken at wholesale or retail level and included Danish produced as well as imported poultry meat (Table A6 and A7). The results showed that the decline in the prevalence of *Campylobacter* in Danish produced chicken meat observed in 2004 was maintained in 2005 (Figure 19). It is likely that the introduced interventions have contributed to this decrease. The prevalence of *Campylobacter* in imported frozen chicken meat increased in 2005 as compared to the preceding years. The numbers of *Campylobacter* were higher in chilled than in frozen products. A recently reported case-control study supports that consumption of fresh chilled chicken meat increase the possibility for *Campylobacter* infections as compared to consumption of frozen meat.

Surveillance on chilled products was carried out at the two major slaughterhouses producing chilled chicken meat. Samples of packaged products were taken weekly and 17.0% (305/1,793) were positive, which was similar to 2004 where 17.9% was positive. This surveillance continues in 2006.

For chilled imported turkey meat, the prevalence decreased from 59% in 2004 (Table A7) to 31% in 2005. Since 2004, very little turkey meat is processed in Denmark and in 2005 only 4 samples were taken, none were positive.

3.3 Pigs and Cattle

As part of the DANMAP programme, caecal contents from pigs and cattle were sampled at slaughterhouses and examined for *Campylobacter*. In 2005, the prevalence of *Campylobacter* in pigs was 85.4%. The majority of the positive samples was identified as *C. coli* (Table A8). In cattle, the prevalence was 42.5% and all isolates were 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, only samples submitted on clinical indications for *Campylobacter* analysis are examined. *Campylobacter* spp. was found in 13 of 23 samples examined from dogs and from 2 of 3 examined cats. *Campylobacter* spp. was found in 2 of 9 samples from zoo animals (Table A13).

4. Yersinia

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

4.1 Humans

In 2005, there were 241 reported infections with *Yersinia enterocolitica* (4.4 cases per 100,000 inhabitants), which is 6% more than in 2004 (Table A1). Since 2000, the annual number of infections has been almost unchanged. From 1985 to 2000 the number of cases dropped from more than 1,500 to around 250 cases with *Y. enterocolitica* annually (Figure 20). The infections are believed to be mostly domestically acquired and the majority of patients are children. In 2005, the median age of patients was 11 years. The primary source of human yersiniosis in Denmark is presumably pork and pork products. The geographical distribution of human *Y. enterocolitica* cases is presented in Figure 21.

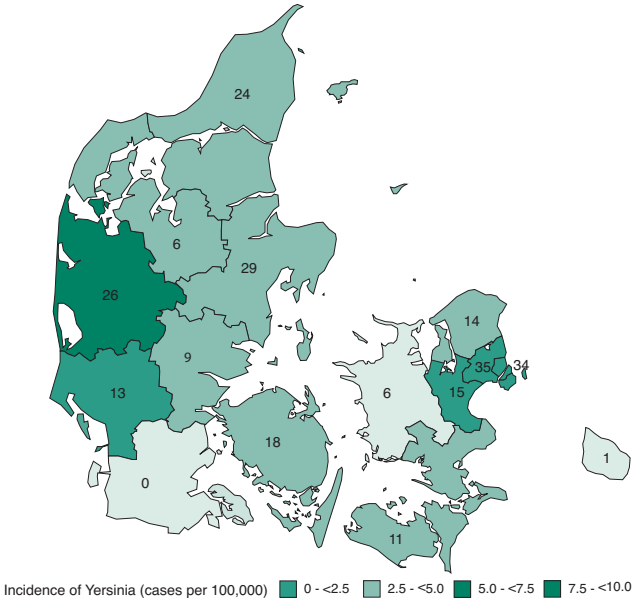


Figure 21. Geographical distribution of the number of cases per county and incidence of human yersiniosis, 2005.
Source: SSI

4.2 Pigs

In 2005, monitoring for *Yersinia* in pigs was discontinued. Until this year, monitoring has been carried out as part of the DANMAP programme, where ceacal contents were sampled from randomly selected pig herds at slaughterhouses and tested for *Y. enterocolitica*. From 1999-2004, between 10.4% and 17.0% of the herds was positive (Figure 22).

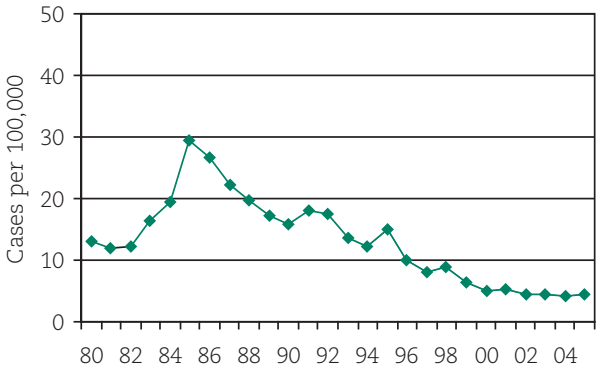


Figure 20. Incidence per 100,000 of human yersiniosis in Denmark, 1980-2005.
Source: SSI

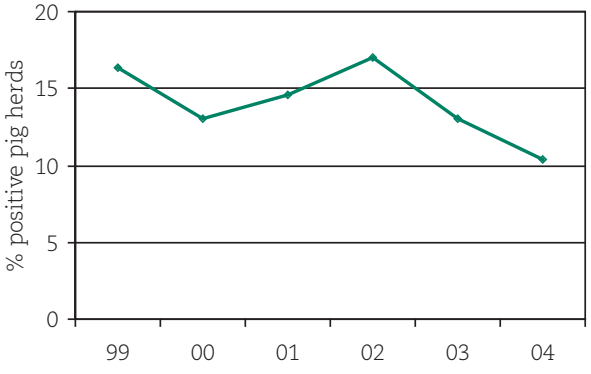


Figure 22. Percent pig herds positive for Yersinia, *1999-2004.*
Source: DFVF

5. Listeria

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

5.1 Humans

In 2005, there were 46 reported cases of listeriosis corresponding to an incidence of 0.8 cases per 100,000 inhabitants (Table A1). Forty-one cases presented with septicaemia, two with meningitis, one had both presentations, one had an incomplete record, and from one patient the bacteria were isolated from synovial fluid from the knee. There were no maternofoetal cases. The patients came from all parts of Denmark; 23 were men and 23 women and the median age was 68 years. Based on sero-grouping and PFGE typing, no clusters could be identified. Thirty-eight cases were assigned to serogroup 1 and seven cases to serogroup 4, while the serogroup was undetermined for one case. During the last 20 years, the incidence of listeriosis has remained relatively stable, being between 0.4 and 0.8 cases per 100,000 inhabitants (Figure 23).

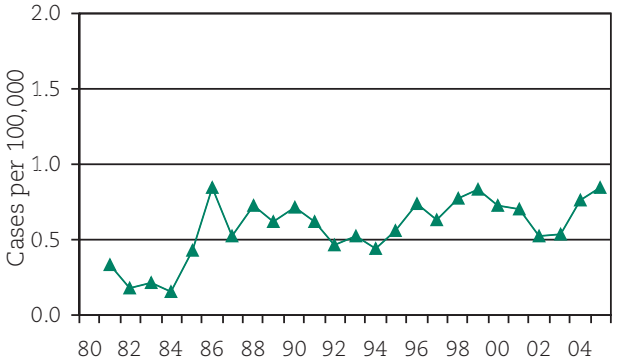


Figure 23. Incidence per 100,000 of human listeriosis in Denmark, 1981-2005.
Source: SSI

5.2 Ready-to-eat food

Since 1998, Denmark has had guidelines on the interpretation of findings of *Listeria monocytogenes*. These guidelines distinguish between products supporting growth of *Listeria* and products not supporting growth and it covers all ready-to-eat foods. For products supporting growth within the shelf-life, findings of *L. monocytogenes* are unacceptable. For products not supporting growth within the shelf-life, findings of *L. monocytogenes* up to 100 cfu (colony forming units)/g are accepted. The results of the monitoring carried out by the RVFCA for *L. monocytogenes* in different food categories is summarised in Table 7.

Table 7. Listeria monocytogenes *in ready-to-eat foods sampled by the RVFCA, 2005.*

	Qualitative method		Quantitative method			
Food category	N	Positive samples[a]	N	Samples with less than 10 cfu[b] pr g	Samples with cfu between 10 and 100 pr g	Samples with more than 100 cfu pr g
Meat products	87	4	456	452	1	3
Milk and dairy products	145	1	9	9	0	0
Eggs and egg product	0	0	0	0	0	0
Fruit and vegetables	23	0	19	19	0	0
Fishery products	30	2	178	176	2	0
Other products[c]	36	0	35	35	0	0
Total	321	7	697	691	3	3

[a] *Listeria monocytogenes* present in a 25 g sample of the the product.
[b] cfu: The number of colony forming units.
[c] predominantly ready-to-eat dishes
Source: DVFA

6. Verocytotoxin-producing Escherichia coli (VTEC)

6.1 Humans

In 2005, there were 154 reported episodes of verocytotoxin-producing *Escherichia coli* (VTEC) infections with an incidence of 2.8 per 100,000. Overall, the annual number of episodes has been increasing since 1997 (Figure 24). Improved diagnostic methodologies and increased awareness plays an important role in this increase. The number of reported infections in 2005 was 9% lower compared to 2004. However, no general outbreaks were recorded in 2005 whereas two outbreaks involving 30 reported patients occurred in 2004, and thus more sporadic episodes were recorded in 2005. VTEC cultures were obtained from 146 episodes (the remaining being found by PCR only), 17% of which were caused by O157 (Table A1). The total distribution of VTEC O-groups, resulting in five or more episodes is presented in Table 8.

Denmark does not have a centrally coordinated standard testing method for VTEC. It should be noted that the incidence through the past nine years (1997-2005) has been 3 to 10 times higher in counties using a diagnostic approach involving molecular detection methods. These counties covered approximately 43% of the Danish population in 2005 and have been circled in Figure 25 presenting the geographical distribution of human VTEC infections in Denmark. In 2005, the age group specific incidence in counties using molecular methods was 20.5 in children less than 5 years and 4.4 in cases aged 5 years or more compared to 9.8 and 0.3 respectively in counties using other methods.

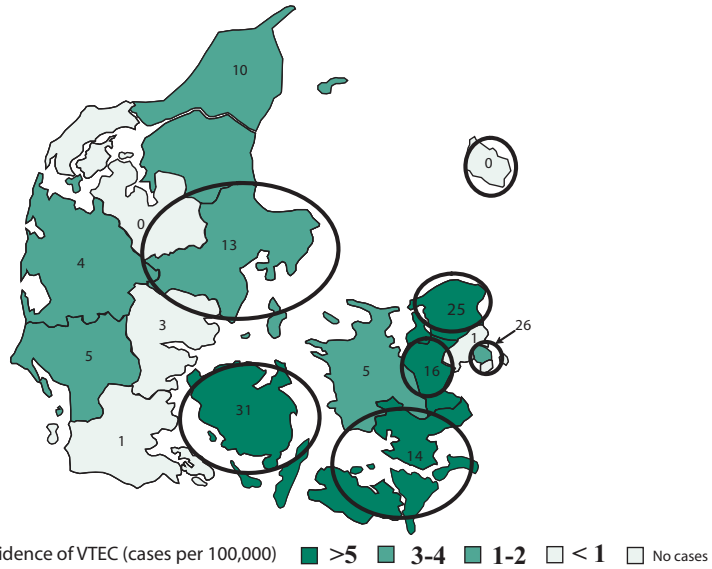


Figure 25. Regional differences in Danish VTEC infections. Number of diagnosed VTEC infections and annual incidence of VTEC infections by county in 2005. The circled counties offer testing by molocular detection.
Source: SSI

Six cases of HUS were reported in 2005. VTEC strains were isolated from three cases, one of which had two different VTEC strains (O157:H- and O145:H-). The other two cases had one each of serotype O111:H- and O157:H7. One case was positive by PCR only. In two HUS cases, eae positive *E. coli* were isolated, but not further characterised. One HUS case was complicated by ornithosis. In 2005, all VTEC isolates were real-time sub-typed using PFGE at the SSI.

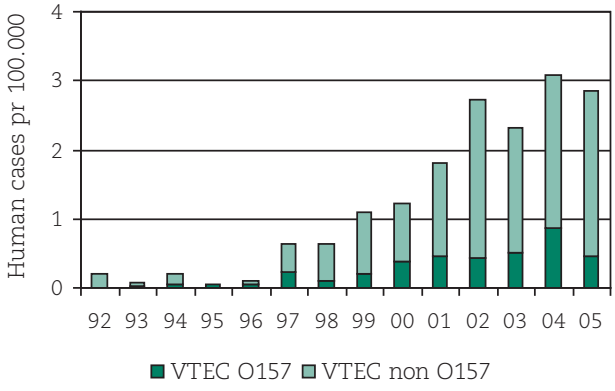


Figure 24. Incidence of human infections with VTEC, 1992-2005.
Source: SSI

Table 8. VTEC O-group distribution in 2005. All O-groups that resulted in five or more episodes are listed.

O group	Number of episodes
O157	25
O103	23
O26	16
O128ab/c	11
O117	11
O rough	9
O145	7
O146	7
O111	6
Other O groups	31
TOTAL	146

Source: SSI

6.2 Cattle

The DFVF has monitored the occurrence of verocytotoxin producing *E. coli* of serogroup O157 (VTEC O157) in cattle since 1997 through examination of faecal samples from slaughter calves. The samples were collected at slaughterhouses as part of the DANMAP programme. In 2005, VTEC O157 was detected in 3.7% (6/165) of faecal samples from slaughter calves. There is a marked seasonal variation in the findings of VTEC O157 in slaughtered calves, and most VTEC O157 shedding animals are observed between April and October.

From March to December 2005, a survey concerning VTEC in feacal samples from cattle at slaughter was carried out (primarily slaughter calves and cows originating from dairy farms). In total, 500 samples were investigated for the presence of VTEC of serogroup O26, O103, O111, O145, and O157 by methods which included an immunomagnetic separation step. VTEC O157 was isolated from 18 animals (3.6%). None VTEC serogroup O26, O103, O111, and O145 were recovered in the survey.

The occurrence of VTEC O157 on cattle carcasses was investigated in a study where surface swabs from 474 carcasses were analysed. The study included 9 slaughterhouses. Most of the carcasses investigated were either slaughter calves or cows originating from dairy farms. The study was performed in the spring and autumn. VTEC O157 was isolated from 16 carcasses (3.4%).

In 2005, a survey concerning the occurrence of VTEC in imported beef and veal was carried out. Samples were collected at importers and at the border controls. A total of 554 samples was collected from 111 batches, five samples from each batch. The samples were examined for *E. coli* O26, O103, O111, O145 and O157. Four samples were positive with *E. coli* O103, 2 samples positive with *E. coli* O26 and 1 sample was positive with 1 *E. coli* O157. None of the isolates were verocytotoxin-producing.

6.3 Pigs

The DVFA performed a study where faecal samples from slaughter pigs were investigated for *E. coli* O157. A total of 294 animals was investigated. *E. coli* O157 was isolated from three samples, but none of these isolates were verocytotoxin-producing.

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 continued throughout 2005, but with minor changes to the programme (for legislation see Table A14). BSE testing of samples from slaughtered animals (all slaughters above 30 month of age) 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 are presented in table 9). 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 2005, Denmark tested a total number of 216,687 normal slaughter animals without finding any animals positive for BSE. A total of 36,225 fallen stocks were also tested, and one was found to be positive for BSE (Table 9). The positive animal was a 9 year old cow from the Northern part of West Jutland. The geographical distribution of BSE positive herds identified from 2000-2005 is shown in Figure 26.

Figure 26. Geographical distribution of BSE positive herds in Denmark, 2000-2005. 3 cases were exported to other EU countries, two cases were exported in 2002 and one case was exported in 2003.
Source: DVFA

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. In 2005, OIE adopted a simplified model for BSE country classification. The new model consists of

Table 9. BSE surveillance programme for cattle, 2005.

Type of surveillance	N	Positive
Active surveillance		
Healthy slaughtered animals (>30 mo.)	216,687	0
Risk categories:		
Emergency slaugthers (>24 mo.)	2,024	0
Slaughterhouse ante-mortem inspection revealed suspicion or signs of disease (>24 mo.)	9	0
Fallen stock (>24 mo.)	36,225	1
Animals imported from the UK	0	-
Animals from herds under restriction	5	0
Passive surveillance		
Animals suspected of having clinical BSE	11	0
TOTAL	254,961	1

Source: DVFA

the three categories negligible risk, controlled risk and undetermined risk. It is not until after the OIE general session in may 2006 that OIE intend to use the new model for BSE country classification when countries apply. The EU expects to amend the rules accordingly.

DFVF has developed a prediction model for the expected number of BSE cases in Denmark for the period 2006 to 2010. The current version of this model assumes a 100% effective feed ban as of January 2002, 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 27).

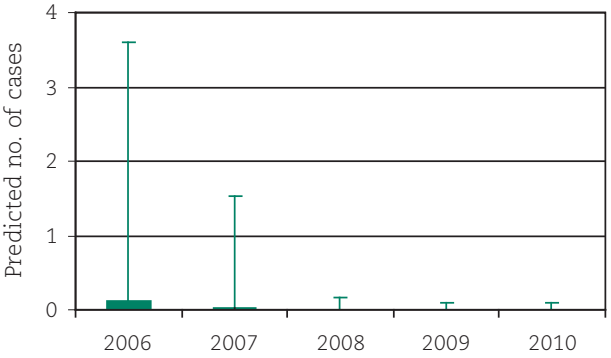


Figure 27. Predictions of the expected number of BSE cases (+confidence interval), 2006-2010.
Source: DFVF

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. In January 2005, the first case of BSE in a goat was confirmed in France. A Commission proposal regarding a BSE monitoring/surveillance program involving testing of all slaughter goats has subsequently been adopted. In Denmark, the surveillance programme for all goats over 18 months, which are slaughtered in slaughterhouses, has been implemented. In 2005, 230 slaughter goats were examined under the new surveillance programme. Furthermore 16 sheep and 19 goats were examined under the voluntary scrapie programme related to export.

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. Brain stem material was used for testing in all cases. In cases where rapid tests showed positive or inconclusive results at one of the private laboratories samples were subjected to confirmatory testing at the DFVF, who employed histopathology and immunohistochemistry techniques to obtain conclusive results. TSE has never been detected in sheep or goats in Denmark. In total, 5,195 fallen sheep and goats were tested in 2005, and all animals were found to be negative for TSE (Table 10).

Table 11. Distribution (%) of prion protein genotype of sheep randomly selected, 2005.

Genotype	Sheep n=100
ARR/ARR	13.0
ARR/AHQ	4.0
ARR/ARQ	21.0
ARR/VRQ	3.0
AHQ/AHQ	1.0
AHQ/ARQ	10.0
ARH/ARH	2.0
ARH/ARQ	1.0
ARQ/ARQ	37.0
ARQ/VRQ	8.0
TOTAL	100

Source: DFVF

Denmark has a population of approximately 200,000 sheep and lambs. In the sheep population, some animals have a genotype that are resistant to scrapie. Although less conclusive, evidence also suggests that the same genotype is 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 2005 like previous years, a study was conducted to determine the prion genotypes from a sample of ovine animals according to the EU regulation No. 999/2001 (as amended). The study consisted of 100 randomly selected animals. Results showed that 13 % of sheep had the resistant prion genotype ARR/ARR (Table 11).

Table 10. The TSE surveillance programme for sheep and goats, 2005.

Type of Surveillance	N	Positive
Active surveillance		
Fallen stock (>18 mo.)	5,195	0
Healthy slaughtered animals (>18 mo.)	346	0
Passive surveillance		
Animals suspected of having clinical TSE	3	0
TOTAL	5,544	0

Source: DVFA

8. Other Zoonoses

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

8.1 *Brucella* spp.

Brucellosis is notifiable in animals, but not in humans and the incidence of brucellosis in humans is unknown.

Humans

In 2005, fifteen cases of brucellosis were identified by serological testing. Eight persons were found to be positive for *B. abortus*, five persons for *B. melitensis* and two for both *B. abortus* and *B. melitensis*. Infection with *B. melitensis* was confirmed by culture in one case. Information about travel history was available in three cases (2 cases with *B. abortus* and one case with *B. melitensis*). All cases had visited countries outside Europe.

Cattle

Abortion clusters in cattle are notifiable. In Denmark, the last outbreak with *Brucella* spp. was recorded in 1962 and Denmark has been officially brucellosis free since 1980. Monitoring is performed by serological analysis of blood samples from the cows under suspicion. Bulls are subject to serological testing pre-entry to bovine semen collection centres and are thereafter examined annually for brucellosis. *Brucella* infections were not observed in any of the 8,052 samples tested in 2005 (Table A9).

Sheep and Goats

Denmark has been declared officially free of brucellosis in sheep and goats since 1979. 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 2005, 4,492 samples from 643 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 2005, *Brucella* infections were detected in 0 of the 23,525 samples tested (Table A8).

Occasionally *B. suis*, biotype 2, is recorded in pigs, latest in 1999. The last couple of outbreaks have been in outdoor pigs and it is believed that the hare population harbours a low infection especially in Central Jutland.

8.2 *Chlamydophilia psittacci* (Ornithosis)

Ornithosis is notifiable in humans and birds.

Humans

In 2005, 22 human cases of ornithosis were reported (Table A1). The patients were between 25 and 71 years old; 18 were men and 4 women. A possible transmission route was reported for 16 cases where all had contact with birds. The infection status was verified by PCR and/or serology in 16 cases, corroborated by serology in 5, and in one case the clinical diagnosis was not laboratory sustained.

Birds

At the DFVF, all domesticated birds submitted to the laboratory are screened for ornithosis. In 2005, a total of 15 birds were found positive for *C. psittacci*; 9 parakeets, 4 parrots and one Hill munah.

8.3 *Leptospira*

Leptospirosis is notifiable in humans and animals.

Humans

In 2005, 24 human cases of leptospirosis, (16 males and 8 females) were diagnosed by serology (MAT test). All patients recovered. *L. interrogans* ichterohaemorrhagiae accounted for 25% of these infections, the remaining were caused by a number of serovars including sejrø, patoc, saxkøbing, poi, hurstbridge and bratislava. There was a clear seasonal variation with 8 cases reported during Jan–Feb and 6 cases in November. No cases were reported from July to October.

The vast majority of the cases were domestically acquired and several patients had directly or indirectly been exposed to rat urine.

Pigs

In farm animals, suspicion of leptospirosis is often based on increased incidence of abortions or other reproductive problems in a herd. In 2005, a total of 270 samples, mainly from swine, were investigated by immunoflourescence techniques and *Leptospira* was detected in a single sample, from a case of abortion in a pig herd localized at the island of Lolland.

8.4 *Mycobacterium bovis*

Mycobacterium bovis infection is notifiable in humans and cattle.

Humans

In 2005, no human cases of *M. bovis* were reported.

Cattle

Danish cattle herds have been declared officially tuberculosis free since 1980. Meat inspectors at the slaughterhouses monitor for the presence of TB lesions in slaughtered animals. In 2005, 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 1994, *Mycobacterium bovis* has not been detected in deer in Denmark.

Pigs

Meat inspectors at the slaughterhouses monitor for the presence of TB lesions in slaughtered animals. In 2005, no positive cases were observed (Table A8).

8.5 *Cryptosporidium* spp.

Cryptosporidiosis is not notifiable and therefore 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 2005, 66 sporadic cases were reported (Table A1). Approximately 90% of the diagnosed cases are acquired from travel abroad. An additional 99 patients were recorded in connection with a large outbreak; and 16 of these cases were laboratory comfirmed (see Section 1.2).

Mammals

At present, there are 14 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, and can be performed upon request.

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 2005, 2,515 faecal samples from mammals were analysed. Of the bovine samples, 21.6% were positive for *Cryptosporidium*. This is a slight increase of 1.7% compared to 2004. Of samples from dogs and cats with diarrhoea, 10.9% and 9.1%, respectively, were positive for *Cryptosporidium* (Table A13). Among samples from other animal species submitted to the DFVF for diagnosis, the occurrence of *Cryptosporidium* did not exceed 2%.

8.6 *Echinococcus granulosus/multilocularis*

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

Humans

In 2005, 19 cases were reported (Table A1). Four cases were infected with *E. multilocularis* and 15 cases with *E. granulosus*.

Animals

Surveillance for *E. granulosus* is performed as part of the routine meat inspection at the slaughterhouse. There were no findings in 2005. No foxes were tested specifically for *E. multilocularis* at the DFVF in 2005.

8.7 *Toxoplasma gondii*

Toxoplasma gondii infection is not notifiable in Denmark, and the incidence of toxoplasmosis in humans is unknown. However, since 1999 a nationwide neonatal screening system for congenital toxoplasmosis has been carried out (Figure 28). In 2005, 64.189 newborns were tested, 9 were positive (Table A1).

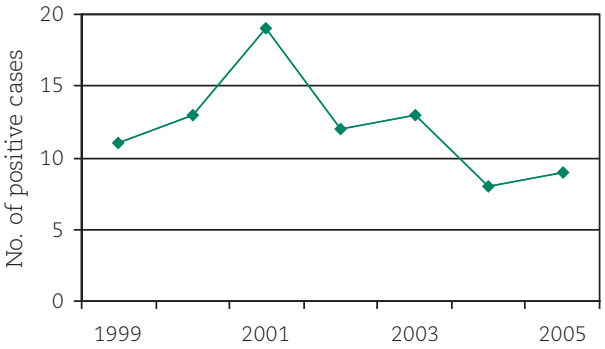


Figure 28. Number of children born with congenital toxoplasmosis detected by the national neonatal screening program in Denmark, 1999-2005.
Source: SSI

8.8 *Trichinella* spp.

Trichinella spp. is notifiable in animals, but not in humans. The infection has not been recorded in domestic animals since 1930.

Humans

The incidence of human trichinellosis in Denmark is unknown. One case was reported in 2005 (Table A1).

Pigs and wild boars

All pigs slaughtered at Danish export approved slaughterhouses are examined for *Trichinella* spp. in accordance with Council Directive 64/433/EEC. During 2005, samples from 22,147,738 pigs were examined, and none of the samples were found to contain *Trichinella* spp.. It is also compulsory to examine slaughtered wild boars. In 2005, 1,552 wild boars were examined, all of which were negative.

Horses

All horses which are slaughtered at Danish export approved slaughterhouses are examined for *Trichinella* spp.. During 2005, samples from 1,476 horses were examined, and all samples were negative.

8.9 *Lyssa virus* (Rabies)

Rabies is notifiable in humans and animals.

Humans

No human cases of rabies were reported in 2005 (Table A1), however, 10 people underwent prophylactic treatment following bites from bats. Two of the attacking bats were examined and one found positive for European Bat Lyssa virus (EBL). In addition, 78 people were treated by prophylactic vaccination following exposure abroad to bites from animals suspected of being infectious.

Animals

The classic sylvatic rabies virus, lyssa virus type 1, has not been reported in Denmark since 1982 where one case was reported in a cow in a border area. Nor has it been reported from closely surrounding areas for several years. It is, however, endemic in Greenland, where arctic foxes occasionally transmit the disease to sledge dogs and other animals.

Bat monitoring for the EBL is performed according to Rule no. 432 of 09/06/2004, and this virus has been detected in the Danish bat population since 1985. In 2005, 15 wild bats were submitted to the DFVF for EBL testing and two were found to be positive for the virus. One dog, one hedgehog and six cats were also examined and found negative.

An increased interest in the potential risk of exposure of cats to EBL from bats was raised during 2005. It is known that cats can be experimentally and fatally infected with EBL, but EBL has never been detected in cats submitted for diagnosis in Denmark. In summary, the risk of exposure of humans from cats is considered very low.

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 2005 DANMAP report will be available at the end of June 2006 from: www.danmap.org, or may be ordered from the Danish Zoonosis Centre (dzc@dzc.dk).

Appendix

Data tables

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

	Incidence per 100,000	Registered no. of cases						
Zoonotic pathogen	2005	2005	2004	2003	2002	2001	2000	1996
Bacteria								
Brucella abortus/melitensis [a, d]	-	15	4	14	16	18	-	0
Campylobacter coli/jejuni [b]	68.0	3,671	3,724	3,536	4,379	4,620	4,388	2,971
Leptospira spp. [b]	0.5	24	33	13	13	6	21	-
Listeria monocytogenes [b]	0.8	46	41	29	28	38	39	39
Mycobacterium bovis [b]	0	0	2	1	2	4	12	11
Chlamydia psittaci [b]	0.4	22	8	14	13	9	31	-
Salmonella spp. [b]	33.0	1,775	1,538	1,712	2,071	2,918	2,339	3,258
S. Enteritidis [b]	11.9	642	546	735	1,105	1,416	1,212	1,770
S. Typhimurium [b]	10.4	565	467	449	382	589	437	907
Other serotypes [b]	10.5	568	525	528	584	913	690	581
VTEC total [b]	2.8	154	168	128	143	90	60	5
O157	0.5	25	47	27	23	24	20	3
other or non-typeable	2.4	129	121	101	120	66	40	2
Yersinia enterocolitica [b]	4.4	241	228	243	240	286	266	530
Parasites								
Cryptosporidium spp. [a, d]	-	82	-	-	-	-	-	-
E. multilocularis [a]	-	4	-	-	-	-	-	-
E. granulosus [a]	-	15						
Toxoplasma gondii [a,c]	-	9	8	13	12	19	13	-
Trichinella spp. [a,d]	-	1	-	-	-	-	-	-
Viruses								
Rabies [b]	0	0	0	0	0	0	0	0

[a] Not notifiable.
[b] Notifiable.
[c] Nation-wide neonatal screening for congenital toxoplasmosis; 64.189 newborns tested in 2005.
[d] Data presented do not provide an accurate estimate of the incidence as the results are from one laboratory (SSI), representing only a proportion of the Danish population (approximately 1/3 in 2005). The proportion of the population represented varies from year to year, thus results from different years are not comparable. Testing for these pathogens is carried out only if specifically requested on the submission form.
Source: SSI

Appendix

Table A2 Phagetype distribution (%) of S. *Enteritidis from humans, animals, carcasses and imported meat, 2005.*

	Human n=603	Layer flocks[b] n=6	Broiler flocks[c] n=6	Import[d] Chicken n=45
PT8	29.9	33.3	0	8.9
PT4	14.9	0	0	42.2
PT21	14.1	16.7	0	22.2
PT1	11.6	0	0	0
PT6	3.5	50.0	50.0	8.9
PT6A	2.7	0	0	4.4
PT1B	1.0	0	50.0	0
PT29	0.5	0	0	0
PT6B	0.3	0	0	6.7
PT12	0.2	0	0	2.2
PT30	0.2	0	0	2.2
Others	13.1	0	0	2.2
NT	8.1	0	0	0
TOTAL	100	100	100	100

Footnotes: See Table A4.
Source: DVFA, DFVF and SSI

Table A3. Phagetype distribution (%) of S. Typhimurium from humans, animals, carcasses and imported meat, 2005.

	Human n=525	Pork[a] n=94	Broiler flocks[c] n=24	Imported meat[d] Pork n=51	Beef n=8	Chicken n=4	Turkey n=4	Duck n=7
DT104	23.8	2.1	0	7.8	75.0	50.0	0	14.3
DT120	16.4	21.3	37.5	13.7	0	0	50.0	0
DT12	13.1	14.9	0	2.0	0	0	0	0
DT193	9.0	7.4	8.3	11.8	12.5	25.0	0	0
DTU302	3.8	1.1	0	11.8	0	0	0	0
DT170	2.5	17.0	8.3	0	0	25.0	0	0
DT136	1.7	0	0.0	0	0	0	0	0
DT1	1.3	0	0.0	0	0	0	0	0
DT17	1.1	3.2	12.5	2.0	0	0	0	0
DT41	1.1	0	0	0	0	0	0	0
DT44	1.1	0	0	0	0	0	0	0
DT135	1.1	1.1	8.3	0	0	0	0	0
Others	8.8	5.3	25.0	15.7	12.5	0	25.0	71.4
NT Total	15.0	26.6	0	35.3	0	0	25.0	14.3
TOTAL	100	100	100	100	100	100	100	100

Footnotes: See Table A4.
Other phagetyped S. Typhimurium isolates: 1 Beef isolate (DT120).
Source: DVFA, DFVF and SSI

Table A4. Serotype distribution (%) of Salmonella *from humans, animals carcasses at slaughterhouse and imported meat, 2005. In some cases more than one serotype was found per positive herd/carcasses/batch and therefore the number of typed units may be greater than the number of positive herds/carcasses/batches.*

	Human n=1775	Pork[a] n=190	Beef[a] n=32	Layer flocks[b] n=7	Broiler flocks[c] n=86	Duck flocks[c] n=231	Imported meat[d] Pork n=110	Beef n=15	Chicken n=118	Turkey n=60	Duck n=19
Enteritidis	36.2	0	0	85.7	8.1	0	0	6.7	38.1	0	0
Typhimurium	31.7	49.5	3.1	0	27.9	0	46.4	53.3	3.4	6.7	36.8
Newport	2.1	0	0	0	0	0	0	0	2.5	5.0	0
Stanley	1.9	0.5	0	0	0	0	0	0	0	0	0
Virchow	2.0	0	0	0	1.2	0	0	0	2.5	0	0
Infantis	1.7	5.3	0	14.3	24.4	0	2.7	20.0	8.5	0	0
Dublin	1.4	0	78.1	0	0	0	0	0	0	0	0
Hadar	1.3	0	0	0	0	0.9	0	0	3.4	13.3	0
Kentucky	1.2	0	0	0	3.5	0	0	0	0	0	0
Agona	1.0	0.5	0	0	0	0.4	2.7	0	1.7	6.7	0
Indiana	0.7	0	0	0	8.1	22.1	0	0	15.3	0	15.8
Anatum	0.6	0	0	0	0	19.0	0	0	0	0	0
Derby	0.6	20.0	0	0	9.3	0	13.6	0	0	5.0	0
Saint paul	0.6	0	0	0	0	0	0	0	0	16.7	15.8
Heidelberg	0.6	0.5	0	0	1.2	0	0	0	0.8	3.3	0
Other	16.3	10.5	15.6	0	15.1	49.8	32.7	20.0	23.7	43.3	31.6
NT	0.1	13.2	3.1	0	1.2	7.8	1.8	0	0	0	0
TOTAL	100	100	100	100	100	100	100	100	100	100	100

[a]Swab samples of pork and beef carcasses from the surveillance programme at slaughterhouses.
[b]Represenative samples from the surveillance programme in prodution flocks.
[c]Representative faecal or sock samples from the mandatory AM inspection prior to slaughter.
[d]Monitoring of imported meat and meat products.
Source: DVFA, DFVF and SSI

Table A5. Occurrence of Salmonella *in the table-egg production, 2005.*

Zoonotic pathogen	Rearing breeding N= 16 Positive flocks	Adult breeding N= 9 Positive flocks	Pullet-rearing N= 255 Positive flocks	Table-egg production N= 658 Positive flocks
S . Enteritidis	-	-	6	6
S. Typhimurium	-	-	-	-
Other serotypes	-	-	-	1
TOTAL	0	0	6	7

Source: DVFA

Table A6. Occurrence of Salmonella *and* Campylobacter *in the broiler production in Denmark, 2005.*

	Adult breeders		Broiler flocks		Slaughterhouse		Non-heat treated broiler meat	
	Flocks		Flocks		Batches		Samples	
Zoonotic pathogen	N	Positive	N	Positive	N	Positive	N	Positive
Salmonella spp.								
Danish	60	0	4,083		1,174	27	-	-
S . Enteritidis	-	-	-	6	-	-	-	-
S. Typhimurium	-	-	-	22	-	-	-	-
Other serotypes	-	-	-	56	-	-	-	-
Imported	-	-	-	-	-	-	1045[a]	122
TOTAL	60	0	4,083	84	1,174	27	1,045	122
Campylobacter spp.								
Danish	-	-	4,918[b]	1,471	-	-	2,686	514
Imported	-	-	-	-	-	-	389	260
TOTAL	-	-	4,918	1,471	-	-	3,075[c]	774

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

Table A7. Occurrence of Salmonella *and* Campylobacter *in the turkey production, 2005*[a].

	Flock level		Slaughterhouse		Non-heat treated turkey meat	
	Flocks		Batches		Samples	
Zoonotic patogen	N	Positive	N	Positive	N	Positive
Salmonella spp.						
Danish	8	0	22	0	-	-
Imported	-	-	-	-	627	71
TOTAL	8[b]	0	22	0	627[c]	71
Campylobacter spp.						
Danish	-	-	-	-	4	0
Imported	-	-	-	-	612	190
TOTAL	-	-	-	-	616	190

[a] From 2004, commercially raised turkeys were no longer slaughtered in Denmark.
[b] Flocks monitored by sock samples 2-3 weeks prior to slaughter and by end-product samples after slaughter.
[c] Import control.
Source: DPC and DVFA

Appendix

Table A8. Occurrence of zoonotic pathogens in pigs and pork in Denmark, 2005.

	Primary production			Slaughterhouse (slaughtering >50 pigs pr month)		Slaughterhouse (slaughtering 50 or less pigs pr month)		Non-heat treated pork cuts and products	
	Herds	Herds	Animals	Samples		Samples		Samples	
Zoonotic pathogen	N	Positive	N	N	% Positive	N	% Positive	N	Positive
Bacteria									
Salmonella spp.									
Danish	11676[a]	474	408,343	30,730[b,h]	1.0	79[b,h]	1.3	-	-
Imported	-	-	-	-	-	-	-	1,372[c]	113
TOTAL	11,676	474		30,730	1.0	79	1.3	1,372	113
Campylobacter spp.									
C. jejuni	-	4	-	-	-	-	-	-	-
C. coli	-	154	-	-	-	-	-	-	-
C. lari	-	0	-	-	-	-	-	-	-
Other serotypes	-	0	-	-	-		-	-	-
TOTAL	185	158	185[d]	-	-	-	-	-	-
Brucella abortus	893	0	23,525[e]	-	-	-	-	-	-
Mycobacterium bovis	-	0	21,828,400[f]	-	-	-	-	-	-
Parasites									
Trichinella spp.	-	0	22,147,738[g]	-	-	-	-	-	-

[a] Data are from December, 2005. Herds monitored using serological testing. Herds belonging to level 2 and 3 were defined as Salmonella positive.
[b] Swaps 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, every 18 month, and prior to release from semen collection centres.
[f] Slaughtered pigs were examined by slaughterhouse meat inspectors.
[g] Samples from pigs slaughtered at export approved slaughterhouses were examined using the method described in Directive 77/96/EEC.
[h] The serotype distribution was not available as we go to press. An errantum will be placed at the DFVF website www.dfvf.dk together with the report.
Source: DVFA and DFVF

Table A9. Occurrence of zoonotic pathogens in cattle and beef in Denmark, 2005.

	Primary production			Slaughterhouse (slaughtering >50 cattle pr month)		Slaughterhouse (slaughtering 50 or less cattle pr month)		Non-heat treated beef cuts and products	
	Herds	Herds	Animals	Samples		Samples		Samples	
Zoonotic pathogen	N	Positive	N	N	% Positive	N	% Positive	N	Positive
Bacteria									
Salmonella spp.									
Danish	-	-	-	9,550[b,c]	0.6	282[b,c]	0.7	-	-
Imported	-	-	-	-	-	-	-	1,604[d]	19
TOTAL	-	-	-	9,550	0.6	282[b]	0.7	1,604	19
Campylobacter spp.									
C. jejuni	-	31	-	-	-	-	-	-	-
C. coli	-	0	-	-	-	-	-	-	-
Other species	-	0	-	-	-	-	-	-	-
TOTAL	73	31	73[a]	-	-	-	-	-	-
Brucella abortus	739	0	8,052[e]	-	-	-	-	-	-
Mycobacterium bovis	-	0	519,099[f]	-	-	-	-	-	-
VTEC 0157	165	6	165[a]	-	-	-	-	-	-

[a] Caecal content was tested from one animal per herd, collected at slaughter (DANMAP programme).
[b] Swaps 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 pigs per month where samples are analysed individually.
[c] The serotype distribution was not available as we go to press. An errantum will be placed at the DFVF website www.dfvf.dk together with the report.
[d] Import control.
[e] Bulls were examined upon admission to semen collection centres, and annually hereafter.
[f] Slaughtered cattle were examined by the slaughterhouse meat inspectors.
Source: DVFA and DFVF

Table A10. Number of Salmonella *positive batches obtained from imported meat, 2005.*

	Batches examined	Batches positive	Positive for DT104
Chicken/hen	226	59	-
Turkey	125	33	-
Pork	285	66	-
Beef	311	9	-
Other	155	23	-
TOTAL	1,102	190	17

Source: DVFA

Table A11. Control of Salmonella *in compound feeds, feed processing and feed materials in 2005.*

	2005 Samples		2004 Samples		2003 Samples		2002 Samples	
	N	Positive	N	Positive	N	Positive	N	Positive
Feed processing plants (process control):								
Ordinary inspections	1,885	29[a]	2,008	30	2,409	34	2,740	33
Additional inspections	175	15	156	21	241	46	262	48
Feed materials, farm animals	1,119	72[b]	1,127	49	144	2	269	5
Transport vehicles, hygiene samples	254	3[c]	317	3	-	-	-	-

[a]Recorded serotypes: **S.** Falkensee, **S.** Jerusalem, **S.** Mbandaka, **S.** Putten, **S.** Senftenberg, **S.** Youruba, **S.** Livingstone, S.4.12: b:-, **S.** Typhimurium, **S.** Typhimurium DT 170, **S.** Meleagridis, **S.** 4,5,12:i:-, S. Bere, **S.** ru ikke typbar, **S.** Kentucky, **S.** Okatie.
[b]Recorded serotypes: **S.** Rissen, S. Infantis, **S.** Livingstone, **S.** Kentucky, **S.** Agona, **S.** Lexington, **S.** Mbandaka, **S.** Senftenberg, **S.** 0:3:9, **S.** Cubana, **S.**Alachua, **S.** Havana, **S.** Meleagridis, **S.** Ouakam, **S.** Schwarzengrund, **S.** Yoruba.
[c]Recorded serotypes: **S.** Cubana, **S.** Typhimurium DT 104, **S.** Senftenberg.
Source: PD

Table A12. Serotype distribution (%) of Salmonella *from rendering plants, 2005.*

Serotype	Samples n=97
S. Braenderup	1.0
S. Cubana	2.1
S. Infantis	7.2
S. Kentucky	4.1
S. Lille	2.1
S. Livingstone	29.9
S. Mbandaka	1.0
S. Montevideo	23.7
S. Putten	1.0
S. Rough, not typeable	1.0
S. Senftenberg	6.2
S. 4:12:b:-	7.2
Not typable	13.4
TOTAL	100

Source: DVFA

Appendix

Table A13. Occurrence of zoonotic pathogens in pets, zoo animals and wild life in Denmark, 2005.

	Pet animals						Zoo animals				Wildlife									
	Dog		Cat		Others		Mammals		Birds		Hare		Ruminants		Fox		Others		Birds	
Zoonotic pathogen	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive	N	positive
Bacteria																				
Salmonella spp.	-	1	-	-	-	-	-	1[a]	-	-	-	-	-	-	-	-	-	-	-	-
S . Enteritidis	-	-	-	-	-	-	-	1[b]	-	7[d]	-	-	-	-	-	-	-	15[e]	-	-
S. Typhimurium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15[f]
Others	-	-	-	-	-	-	-	2[c]	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	40	1	8	0	16	0	78	4	122	7	178	0	43	0	19	0	205	15	19	15
Campylobacter spp.	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. jejuni	-	2	-	-	-	-	-	-	-	1[h]	-	-	-	-	-	-	-	-	-	-
C. coli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. upsaliensis	-	8	-	2	-	-	-	1[i]	-	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	23	13	3	2	-	-	8	1	1	1	-	-	-	-	-	-	-	-	-	-
Parasite																				
Cryptosporidia spp.	64	7	22	2	-	-	58	2	-	-	-	1	-	-	-	-	382	7[j]	-	-
Trichinella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,552	0[g]	-	-

[a] Skink: ***Salmonella*** spp.
[b] Turtle: **S**. Enteritidis.
[c] Skink: S. V66:z35:-(a); Dumerilboa: S. Arizonae.
[d] Duck; 2 Southern screamers 2 weavers, 2 parrots: **S.** Enteritidis.
[e] 64 Hedgehogs examined: **S.** Enteritidis.
[f] 14 finches and 1 gull: **S.** Typhimurium.
[g] wild boar.
[h] Zebra finches: *C. jejuni*.
[i] Sheeta: *C. upsaliensis*.
[j] 5 hedgehogs, 1 squirrel, 1 otter.
Source: DFVF

Surveillance programmes

Table A14. Overview of human and animal notifiable and non-notifiable diseases (reported herein) in Denmark, 2005, with reference to the relevant legislation.

	Notifiable in humans	Notification route	Notifiable in animals	EU legislation	Danish legislation
BACTERIA					
Brucella spp.	no	-	1920[i] OBF in 1980[f], no cases since 1962.	Cattle - Decision 2004/320/EEC	Order no 305 of 3/5 2000
			Never detected, ObmF in 1979[g]	Sheep and goats - 2004/320/EEC	Order no. 739 of 21/8 2001,
			-	Pigs - Directive 2003/99/EEC	Order no. 215 of 18/3 1997
Campylobacter spp.	1979[a]	Lab[b]	no	-	
Chlamydophila psittaci (Ornithosis)	1980[a]	Physician[c]	yes	-	Birds - order no. 78 of 30/1 1997
Listeria monocytogenes	1993[a]	Physician	no	-	
Leptospira spp.	1980[a]	Physician	yes	-	Rule no. 432 of 09/06/2004
Mycobacterium bovis/ tuberculosis	1905[a]	Physician (and lab[d])	1920[i] OTF since 1980[h]	Cattle - Decision 2004/320/EEC	Bovine - Order no. 306 of 3/5 2000
Salmonella spp.	1979[a]	Lab	1993[e]	-	-
VTEC	2000[a]	Lab	no	-	-
Yersinia enterocolitica	1979[a]	Lab	no	-	-
PARASITES					
Cryptosporidium spp.	no	-	no	-	-
Echinococcus multilocularis	no		2004	-	-
Echinococcus granulosus	no	-	1993	-	Rule no. 432 of 09/06/2004
Toxoplasma gondii	no	-	no	-	-
Trichinella spp.	no	-	1920[i]	Pigs - Directive 64/433/EEC	Rule no. 432 of 09/06/2004
VIRUSES					
Lyssa virus (Rabies)	1964[a]	Telephone and physician	1920		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	1997[a]	Physician	-	-	-

[a] Danish order no. 277 of 14/04/2000. Cases must be notified to the Statens Serum Institut
[b] The regional microbiological laboratories report confirmed cases.
[c] The physician report individually notifiable infections.
[d] The laboratories voluntarily report confirmed cases.
[e] Only clinical cases notifiable.
[f] OBF according to Council Directive 64/432/EEC as amended by Council Directive 97/12/EC and Commision Decisions 93/52/EEC, 2003/467/EC and 2004/320/EC.
[g] ObmF according to Council Directive 91/68/EEC and Commision Decisions 93/52/EEC, 94/877/EEC, 2003/467/EC and 2004/320/EC.
[h] OTF according to Council Directive 64/432/EEC as amended by Council Directive 97/12/EC and regulation (EC) 1226/2002, and Commission Decision 2003/467/EEC.
[i] Clinical cases, observations during the meat inspection at the slaughterhouse, positive blood sampes or finding of agens are notifiable.
Source: DVFA and SSI

Appendix

Table A15. Salmonella surveillance of the broiler and table-egg production, 2005.

Broiler and Table egg production			
Rearing breeding 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 from 1-4 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 harbor 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, 2005.*

Breeding- and multiplier herds		
Time	Sample taken	Purpose
Every month	10 bloodsamples per epidemiological unit	Calculation of *Salmonella* -index
	Herds with *Salmonella* -index 5 or above: Pen-faecal samples, max twice per year	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, and clarify possible transmission from sow herds to slaughter-pig herds.
Slaughter-pig herds		
Time	Sample taken	Purpose
At slaughter	Meat juice, 60-100 samples per herd per year. Herds in RBOV: one meat juice sample per month	Calculation of slaughter-pig index. Assigning herds to level 1-3 and assigning herds to risk-based surveillance (RBOV)
Herds assigned to level 2 or 3, max. twice per year	Pen-faecal samples	Clarify distribution and type of infection in the herd

Pork carcasses at the slaughterhouse		
No. of samples	Sample taken	Time and no. of animals slaughtered
5 samples daily pooled into one analysis	Swabsamples from 3 designated areas	> 200 pigs slaughter/day
5 samples pr 200 slaughtered pig, pooled into one analysis	Swabsamples from 3 designated areas	> 200 pigs pr. months, < = 200 pigs pr. day
5 samples every 3. month, pooled into one analysis	Swabsamples from 3 designated areas	> 50 pigs pr. month, < 200 pigs pr. month
1 sample every 3. month	Swabsamples from 3 designated areas	< 50 pigs pr. month

Source: DVFA

Table A17. Salmonella ***Dublin*** *surveillance of the cattle production, 2005.*

Milk producing herds		
No. of tests	Sample taken	Herdsize
4 tests per 12 months	Tank milk	all
Non-milk producing herds		
No. of tests	Sample taken	Herdsize
3 tests per 4 months	Blood samples	>=25
3 tests per 12 months	Blood samples	<25

Beef carcasses at the slaughterhouse		
No. of samples	Sample taken	Time and no. of animals slaughtered
5 samples daily pooled into one analysis	Swabsamples from 3 designated areas	> 200 cattles slaughter/day
5 samples pr 200 slaughtered cattle, pooled into one analysis	Swabsamples from 3 designated areas	> 200 cattles pr. months, < = 200 cattles pr. day
5 samples every 3. month, pooled into one analysis	Swabsamples from 3 designated areas	> 50 cattles pr. month, < 200 cattles pr. month
1 sample every 3. month	Swabsamples from 3 designated areas	< 50 cattles pr. month

Source: DVFA

Demographic data

Area of Denmark 44,000 sq km

Human population, 2005.

Age group (years)	Females	Males	Total
0-4	166,289	158,863	325,152
5-14	354,096	336,631	690,727
15-24	309,144	296,436	605,580
25-44	773,897	757,599	1,531,496
45-64	728,530	722,947	1,451,477
> 65	353,890	469,137	823,027
TOTAL	2,685,846	2,741,613	5,427,459

Source: The statistical Yearbook 2005, Danmarks Statistik

Number of herds, livestock and animals slaughtered, 2005.

	Herds	Livestock	Number slaughtered
Broilers	285	19,365,755	123,917,691
Cattle	27,748	1,628,017	519,099
Goats	2,829	19,144	2,584
Horses			2,543
Laying hens excl. barnyard	311	3,498,754	843,955
Pigs	14,072	14,457,972	21,828,400
Sheep & lambs	10,815	196,619	84,717
Turkeys	49	483,778	558

Source: The Central Husbandry Register and DVFA

Number of farms in the broiler production and the table-egg production, 2005.

Broiler production	No. of farms	No. of houses	Livestock
Rearing breeding	19	50	300,000
Adult breeders	45	52	900,000
Hatcheries	6		
Broilers	300	720	20,700,000
Table-egg production			
Rearing breeding	5	6	100,000
Adult breeders	6	7	100,000
Hatcheries	4		
Pullet-rearing	98	136	1,480,000
Layers excl. Barnyard	263	387	3,300,000

Source: DVFA and DPC

Number of herds and lifestock in the pig production, 2005.

	Herds	sows, gilts, boars	Slaughter pigs	Piglets
Breeders and multipliers	271	74,191	243,685	226,660
Sow herds	119	7,592	42,341	292,028
Conventionel	13,116	1,139,335	7,759,948	4,516,114
Freerange	504	22,964	50,641	69,968
Organic	88	2,222	10,952	7,759
TOTAL	13,620	1,162,299	7,810,589	4,586,082

Source: The Central Husbandry register and DVFA

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