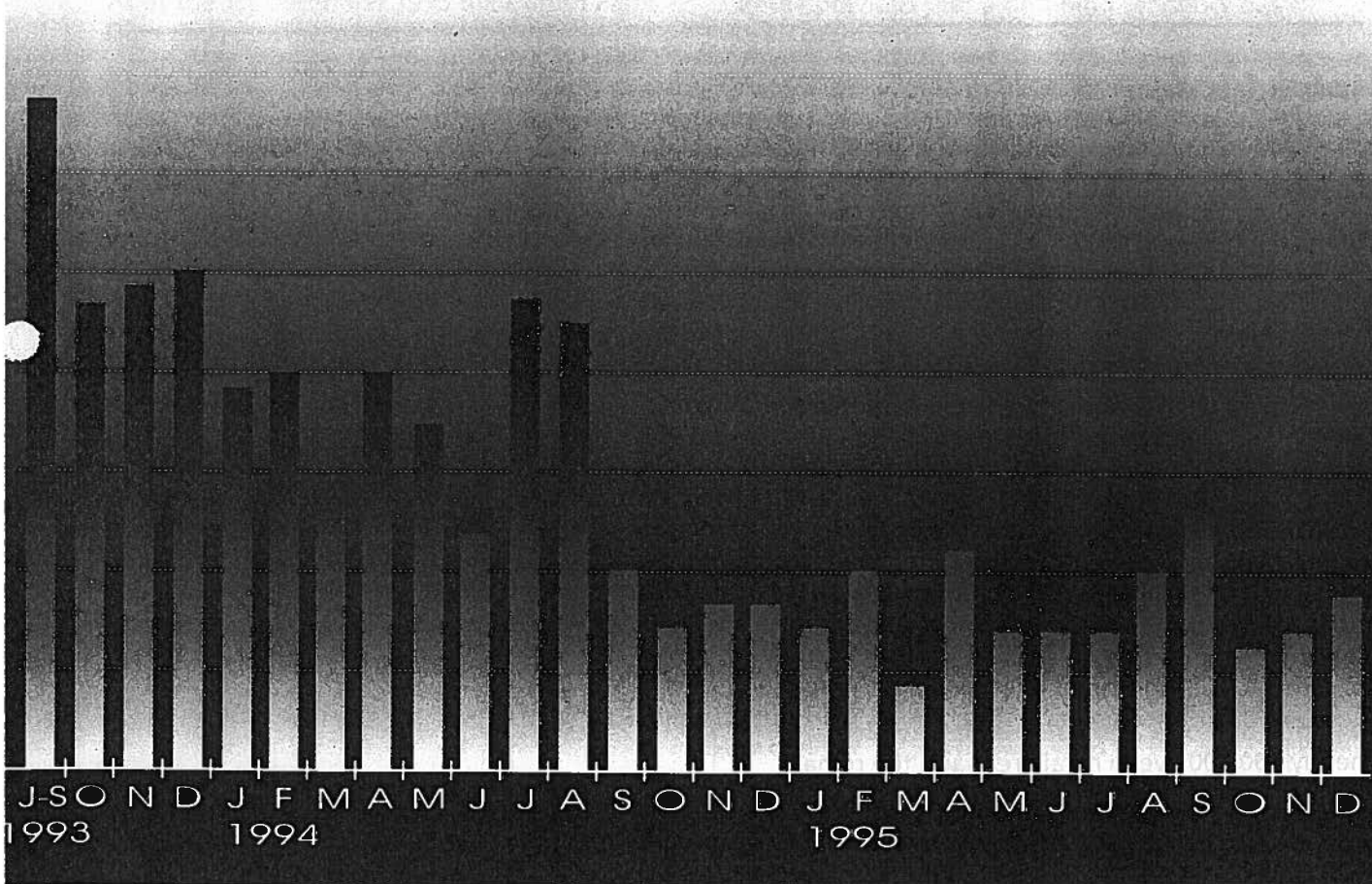




Annual Report on Zoonoses in Denmark 1995



Ministry of Agriculture and Fisheries

Annual Report on Zoonoses in Denmark 1995

Edited by
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Introduction

In March 1995, the third revision of the Danish plan for implementation of the Zoonosis Directive (hereafter called "the Danish plan") was submitted to the Commission. Further information about the origin and method of the collection of the data can be found in the Danish plan.

The data of this report have been collected from the institutions and laboratories mentioned above. This report has been edited by the Danish Zoonosis Centre and the Danish Veterinary Service.

It should be noted that the majority of the egg production takes place in 350 holdings; that nearly all of the broiler production takes place in 360 holdings; and that 85% of the production of slaughter pigs takes place in 7,000 holdings.

Denmark covers an area of 44,000 sq km and has a population of 5.2 million people of which nearly 800,000 live in rural areas and the remaining 4.4 million live in urban areas.

Total number of livestock and herds in Denmark, 1994:

	Livestock	Herds
Cattle	2,104,904	30,915
Pigs	10,922,612	22,716
Laying hens	5,296,000	9,419
Broilers	12,023,000	857
Sheep	144,296	4,339

Approximate total number of animals slaughtered in 1995:

Cattle:	700,000
Pigs:	19 million
Broilers:	113 million

Source: The Statistical Yearbook 1995, Danmarks Statistik.

Table 2. Occurrence of zoonotic pathogens in broilers in Denmark in 1995

Category	Zoonosis	Zoonotic pathogen	Flock level		Slaughterhouse		Retail - broilers and products of broiler meat				Note:		
			Examined flocks	% positive flocks	N	% positive flocks	Neck skin		Not heat treated			Heat treated	
							N	% positive samples	N	% positive samples			
I	Salmonellosis	<i>Salmonella spp.</i>	4168	24.0	4099	45.7	492	6.9	1294	0.3	a		
		<i>S. Enteritidis</i>		0.1		-		0.6		0.1			
		<i>S. Typhimurium</i>		10.4		-		1.4		1			
		Other serotypes		13.5		-		4.9		0.1			
II	Campylobacteriosis	<i>C. coli/jejuni</i>	101	50.5	101	25.7	133	40	0		b		

Data: Danish Veterinary Laboratory, Danish Veterinary Service, Danish Food Agency

- a) Flocks investigated by 60 faecal samples 2-3 weeks prior to slaughter, and 50 neck skin samples at slaughter.
- b) Flocks investigated by 15 cloacal swab samples immediately prior to slaughter and again immediately after slaughter by 10 neck skin samples.

Table 3. Occurrence of zoonotic pathogens in layers and eggs in Denmark 1995

Category	Zoonosis	Zoonotic pathogen	Animal flocks			Retail/whole sale - eggs				Note:
			Examined flocks	Animals	% positive flocks	Not heat treated		Heat treated		
						N	% positive eggs	N	% positive	
I	Salmonellosis	<i>Salmonella spp.</i>	347	34700	5.5	14800	0.1	0		a
		<i>S. Enteritidis</i>			1.7		0.04			
		<i>S. Typhimurium</i>			1.2		0.03			
		Other serotypes			2.6		0.02			

Data: Danish Veterinary Laboratory, Danish Veterinary Service, Danish Food Agency

- a) Monitoring of flocks of egg layers has been carried out by examining 100 rectal swabs taken a few weeks before slaughter of each flock. Eggs from whole sale and retail outlets were collected and investigated as a part of a national screening in the winter of 1995 (see text for details).

Inspection of straight feeding stuffs and raw materials

During the inspection of straight feeding stuffs and raw materials in 1995 Salmonella was found in 19 out of 941 samples corresponding to 2 % of the samples. Salmonella has mainly been found in rape and soybeans.

Serotypes

The serotypes found in feeding stuffs in 1995 are listed in table 1. Only a few of the serotypes found in feeding stuffs appear in connection with salmonellosis in livestock and humans.

Summary

The results of the control by the Danish Plant Directorate indicate that the quality of feeding stuffs has improved during the past year. Salmonella is rarely found in feeding stuffs.

However, the results of the inspection of the feed processing show that the production hygiene can still be improved.

Rendering plants

Control of hygiene at rendering plants is carried out by the animal health section of the Danish Veterinary Service. The products are routinely examined for Salmonella. In 1995 two samples of the final products from rendering plants were found contaminated with Salmonella. The serotypes found were *S. Dublin* and *S. Montevideo*.

Poultry and poultry products

Samples from rearing and breeding establishments and from hatcheries have been collected according to the requirements of the Zoonosis Directive and examined at the Danish Veterinary Laboratory. The total number of localities with hens: 30 rearing establishments, 89 breeding establishments and 10 hatcheries. More than one flock may pass through each establishment annually.

During 1995 4 flocks were suspected of infection with *S. Enteritidis* (1) or *S. Typhimurium* (3) due

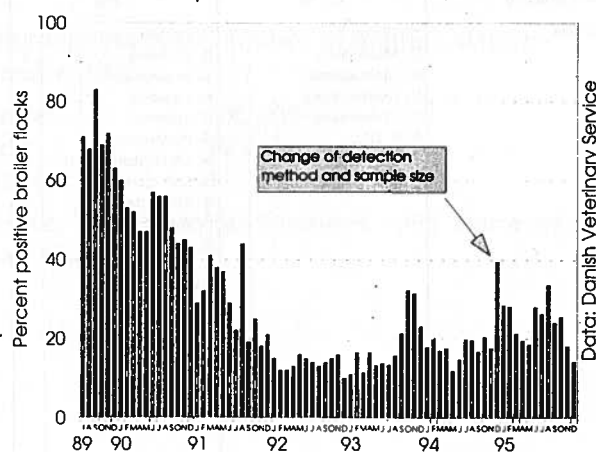


Figure 1. Percent Salmonella positive broiler flocks detected as a part of mandatory ante mortem inspection 1989-95

to isolations of bacteria in hatching material. By examination of 60 killed hens from the suspected flocks, the infection was not confirmed in any flock.

Salmonella was monitored continuously by ante mortem control of all broiler flocks. Sixty faecal samples were collected per flock 2-3 weeks prior to slaughter. The percentage of positive flocks ranged from 12.7% to 36.8% per month with an average of 24% (Table 2, Figure 1).

Salmonella was detected in a total of 45.7% of the flocks after slaughter by investigation of 5 pools each consisting of 10 samples of neck skin from each slaughtered flock (Table 2).

Layers and eggs

A screening for Salmonella in eggs from different production systems was carried out at the end of 1995. A total of 14,800 eggs originating from 148 flocks of layers from five different production systems (caged, floor, free range, ecological and non commercial production) was investigated (Table 3). Eggs were investigated for infection of the egg shell as well as for infection of the interior (white/yolk). Salmonella was detected in eggs from all systems, and no significant differences was observed between the different production systems. A total of 15 (0.1%) contaminated eggs were detected and a single egg (0.07%) contained Salmonella in the white/yolk.

A sample of 30 eggs from each producer were furthermore investigated by a serological method for the presence of Salmonella antibodies in the egg-yolk. High levels of antibodies, indicative of Salmonella infection, were detected in eggs from 25 (17.1%) of 148 investigated layer flocks. This figure stands in contrast to the figure of 19 (5.5%) of 347 flocks investigated by the routine microbiological sampling of 100 cloacal swabs

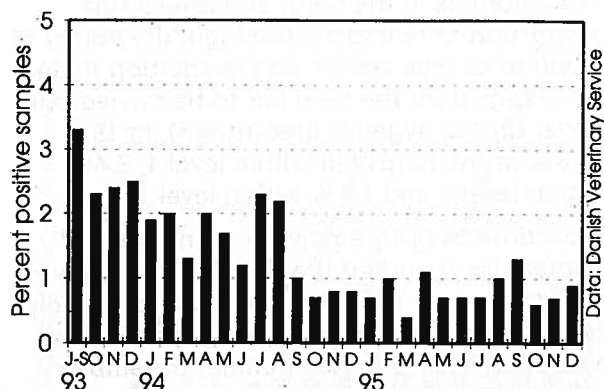


Figure 2. Percent Salmonella positive samples of fresh pork 1993-95

(Table 3). The most likely explanation for this difference is higher sensitivity of the serological detection method.

Serological testing will be part of a new improved plan to control Salmonella in layer breeder flocks and in flocks of layers to be implemented in Denmark in 1996.

Turkeys

Salmonella was detected in 18.5% (32) of 173 turkey flocks investigated by mandatory ante mortem inspection identical to the inspection of broilers (see above). In contrast to broilers all products originating from infected flocks are heat treated.

Pigs and pork products

A serological test for detection of Salmonella infection in pig herds was implemented during 1995. All herds producing more than 100 pigs for slaughter annually are monitored by this test. The herds are divided into three levels based on the number of samples with a serological reaction: level 1 (no or very few reactors, intervention in the herd not required), level 2 (a higher proportions of reactors, the owner of the herd receives advice on how to reduce the prevalence

Table 4. Occurrence of zoonotic pathogens in pigs and pork in Denmark 1995

Category	Zoonosis	Zoonotic pathogen	Herd level			Slaughterhouse				Retail				Note:	
			Herds	Animals	% positive herds	Cuts of pork		Offal		Not heat treated		Heat treated			
						N	% positive samples	N	% positive samples	N	% positive samples**	N	% positive samples**		
I	Tuberculosis	<i>M. bovis</i>	22716	19 mill.	0		0		0		0		0	a	
	Brucellosis	<i>B. abortus</i>			0									b	
	Trichinosis	<i>Trichinella spp.</i>	22716	19 mill.	0		0		0		0		0	a	
	Salmonellosis	<i>Salmonella spp.</i>		15797	605197	5.5	18032	0.81	10380	2.29	3733	1.2	12090	0.1	c
			<i>S. Enteritidis</i>					0.0		0.0		0.03		0.05	
<i>S. Typhimurium</i>							0.57		1.52		0.8		0.01		
		<i>Other serotypes</i>				0.24		0.77		0.37		0.04			
II	Campylobacteriosis	<i>C. coli/jejuni</i>	0	0		0		0		408	1.2	0			
	Yersiniosis	<i>Y. enterocolitica</i>	0	0		0		0		0		0			

Data: Danish Veterinary Laboratory, Danish Veterinary Service, Danish Food Agency

- All slaughter pigs examined in connection with meat inspection.
- Boars examined on admission to AI stations and before leaving the station. No cases found in 1995.
- A detailed table of Salmonella serotype distribution is shown in Table 9. Herds are monitored by serological testing. In this table herds belonging to level 2 and 3 are defined as Salmonella positive herds.

of Salmonella in the herd) and level 3 (the proportion of reactors is too high, the owner is required to seek advice, and in addition slaughter of pigs from the herd has to be carried out under special hygienic precautions). In 1995 94.6% of the herds fell within level 1, 3.4% within level 2 and 2.0% within level 3.

A continuous programme for monitoring of Salmonella in pork at the slaughterhouses was initiated in July 1993. A total of approximately 2,500 samples are analysed every month. For each slaughterhouse the number of samples collected is determined by the actual number of animals slaughtered, as described in the Danish plan. The number of Salmonella positive fresh meat samples varied from 0.4% in March to 1.3% in September with an average of 0.8% through all of 1995 (Figure 2, Table 4). The distribution of Salmonella serotypes and phage-types in pork at the slaughterhouses largely reflects the distribution of types in the herds (Tables 9 and 11). It is noteworthy that Salmonella Choleraesuis is not present in Danish pig herds.

Clinical salmonellosis was recorded in 52 herds (Table 5). The figure was calculated by the number of herds submitting material from clinically affected animals to the laboratory. Clinical salmonellosis in pigs is a recent phenomenon in Denmark. Ten years ago it was virtually

Table 5. Pigs: Isolations of Salmonella in material from outbreaks of clinical disease

Serotype	No. 1995	No. 1994	No. 1993	No. 1992	No. 1991	No. 1990
Typhimurium	60	83	91	112	42	18
Enteritidis	1					
Infantis		2	10	4	1	2
Derby			6	4		
Berta			1			1
Hadar		1			1	
Dublin	1				1	
Havana						1
Orion				1		1
Taksony						1
16:d:-			1	1		
4.12:b:-		3	7	14	4	4
Worthington			2	1	3	
Falkensee				2		
Agona			1	1		
Anatum				1		
Mbandaka		1	2	2		
Panama		2		2		
Heidelberg		1				
Livingstone		2	2			
Ohio			1			
Saint paul			1			
Meleagridis		1				
Typhimurium/Infantis			1			
Typhimurium/Ohio				1		
Typhimurium/Bredeney						1
Non typable					1	
Total	62	96	126	146	53	29

unknown. As a consequence of the increasing number of herds with salmonellosis a revised regulation came into force in 1993, imposing certain restrictions on herds with clinical salmonellosis. Furthermore, during 1994 and 1995 active surveillance for subclinical Salmonella infections in pig herds was gradually introduced to cover all herds producing more than 100 pigs for slaughter annually. It is not possible to determine with certainty whether active surveillance, a change in the reporting practice, or both is the explanation for the decline in the number of registered cases of clinical salmonellosis.

At the retail level, Salmonella was found in a total of 1.2% of the samples of fresh pork and 0.1% of the samples of heat treated pork (Table 4). The serotype distribution largely reflects the serotypes found in the herds and at slaughter.

Cattle, beef, milk and milk products

Herds of cattle are only investigated for Salmonella infection on clinical indications (salmonellosis). Salmonellosis was diagnosed in 162 (0.5%) cattle herds in 1995. The predominant serovars isolated from clinical cases in cattle in 1995 were S. Dublin (64.8%) and S. Typhimurium (33.3%) (Tables 6 and 7).

At cattle slaughterhouses a total of approximately 250 samples are collected at random each month from a representative sample of the beef

Table 6. Cattle: Isolations of Salmonella in material from outbreaks of clinical disease

Serotype	No. 1995	No. 1994	No. 1993	No. 1992	No. 1991	No. 1990
Dublin	105	92	71	143	167	224
Typhimurium	54	52	46	64	46	54
Enteritidis	3	2	5	2	8	9
Infantis			3		3	1
Thompson						1
Berta						3
Hadar				1	1	1
Kentucky						1
Senftenberg					1	1
4.12:b:-					3	1
Ona						1
Oakland						1
Dublin/Mbandaka						1
Ruiru						1
Agona						1
London						2
Mbandaka					1	1
Montevideo				1		2
Agona/Typhimurium						1
Y:1,5						1
Farmsen					1	1
Tennessee					1	1
Give						1
Ohio					1	
Enteritidis/4.12:b:-						1
Typhimurium/Tennessee						1
Havana						1
Vejle		1				
Total	162	147	127	216	241	299

cuts and the offal. The number of positive samples per month has ranged from 0.0% to 2.1% during 1995 with an average of 0.6%. The predominant serotypes were *S. Typhimurium* (46.3%) and *S. Dublin* (20.4%) (Tables 7 and 9).

In samples collected from retail outlets the number of *Salmonella* positive samples of fresh beef has increased compared to the slaughterhouse control (mean 1.3%), and the serotype distribution does not entirely reflect the distribution at slaughter. This indicates that cross contamination from other meat products takes place during cutting and processing of beef at retail outlets.

A total of 1159 routine samples of milk and milk products were microbiologically tested for *Salmonella*. None were positive.

Antimicrobial resistance

A representative sample of *Salmonella* isolates from animals and food products is routinely monitored for antimicrobial resistance in Denmark. The level of antimicrobial resistance in *Salmonella* isolated from Danish animals and food products was very low in 1995 as it has been in previous years, and multiple resistant *Salmonella* isolates were only very rarely encountered (Table 12). The lowest level was observed in isolates from poultry and cattle whereas a higher level was observed in isolates from pigs. The observed low level of antimicrobial resistance in animals and food products is reflected in the level observed in domestically acquired cases of salmonellosis in humans (data not shown). A higher level of antimicrobial resistance was observed in *Salmonella* isolated from imported food stuffs as is also the case for human salmonellosis cases contracted abroad (Table 12).

Salmonellosis in humans

The annual number of recorded cases of human salmonellosis caused by zoonotic *Salmonella*

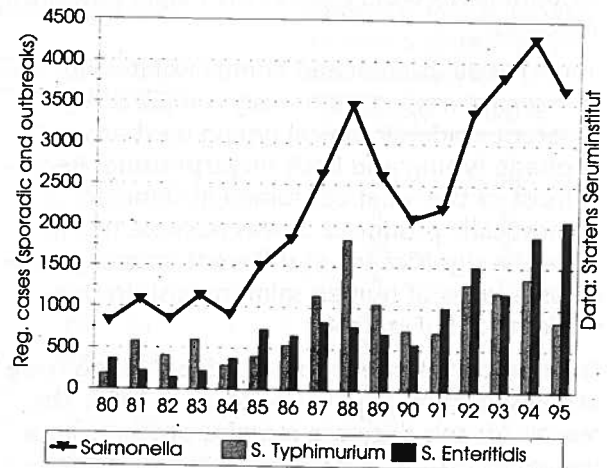


Figure 3. Registered cases of human salmonellosis in Denmark 1980-95

serotypes has increased over the last decade, reaching a maximum of 4,276 cases in 1994 (82.3 cases per 100,000 inhabitants). It is estimated that approx. 85% of the cases are domestically acquired, whereas the remaining 15% may have been contracted while travelling abroad. In 1995 the number of recorded cases decreased to a total of 3,654 (70.3 per 100,000 inhabitants). Predominant serotypes were *S. Enteritidis* (2,070 cases) and *S. Typhimurium* (848 cases), whereas the remaining cases were distributed among approximately 100 different serotypes (Table 8). *S. Newport* (188 cases), *S. Hadar* (58 cases) and *S. Virchow* (53 cases) predominated among the serotypes of minor importance in 1995. The phage type distribution of *Salmonella Typhimurium* and *Salmonella Enteritidis* can be seen in Table 10 and 11.

In 1995, a further increase in the number of infections caused by *S. Enteritidis* was observed compared to 1993 and 1994 (Figure 3). Investigations primarily based on epidemiological typing of bacterial isolates and investigations of outbreaks have pointed to the consumption of

Table 7. Occurrence of zoonotic pathogens in cattle and beef in Denmark 1995

Category	Zoonosis	Zoonotic pathogen	Herd level			Slaughterhouse				Retail				Note:	
			Examined			Cuts of beef		Offal		Not heat treated		Heat treated			
			Herds	Animals	% positive herds	N	% positive samples	N	% positive samples	N	% positive samples	N	% positive samples		
I	Tuberculosis	<i>M. bovis</i>			0	All	0	All	0						a
	Brucellosis	<i>B. abortus</i>			0							0		0	a
	Salmonellosis	<i>Salmonella</i> spp.				2165	0.60	1286	0.86	2559	1.3	3575	0.06		b
		<i>S. Enteritidis</i>					0.00		0.08		0.1		0.03		c
		<i>S. Typhimurium</i>					0.23		0.39		0.9		0.00		
		<i>S. Dublin</i>					0.18		0.39		0.08		0.00		
		Other serotypes					0.18		0.00		0.22		0.03		
II	Campylobacteriosis	<i>C. coli/jejuni</i>	0	0		0		0		395	1.3	0			

Data: Danish Veterinary Laboratory, Danish Veterinary Service, Danish Food Agency

a) Bulls at AI stations are examined by TB test. Notifiable disease. No cases diagnosed in 1995.

b) Bulls examined on admission to AI stations and annually after entry. Clusters of abortion notifiable. Notifiable disease in cattle.

c) Herds only diagnosed on clinical indication, see also table 7.

contaminated table eggs as the major source of infection.

During 1995, human and animal isolates of Salmonella were continuously compared by different epidemiological typing methods such as phage typing and DNA fingerprinting. Because most of the meat consumed in Denmark is domestically produced, it was possible to estimate the significance of different animal products as sources of human salmonellosis in Denmark in 1995 (Figure 4).

The number of infections with *S. Sandiego* have decreased from 236 in 1994 to 37 in 1995. The reason for this decrease remains obscure, since the source of these infections has never been identified.

During the summer of 1995 an outbreak comprising approximately 150 cases of human salmonellosis caused by *S. Newport* was traced to alfalfa sprouts produced in Denmark from contaminated imported seeds. The exact origin of the seeds by country and the source of contamination could not be traced.

Bean sprouts, notably alfalfa sprouts, show increasing importance as a source of outbreaks of Salmonella infection world wide. The zoonotic nature of such outbreaks may be questioned. However, the most likely explanation for the contamination of the seeds is irrigation with faecally contaminated water or faecal contamination post harvest during shipment from rodents or wild animals. Decontamination procedures for sprouting seeds and control of raw materials as well as process control of every batch of seeds during sprouting may help in reducing the risk of outbreaks.

Only in the case of outbreaks of probable food-borne intestinal disease (defined as two or more cases associated with the same potential source of infection), the Municipal Food Control Authorities will be requested to identify a potential common source of infection. In 1995, 15 outbreaks comprising a total of 238 patients were investigated. The results of these investigations indicated that eggs were the most common source of zoonotic foodborne outbreaks in 1995 (Table 13).

A total of 894 persons reported to the local medical practitioner to have contracted putative food borne infection in 1995, 75 of these assumed they had contracted their infection abroad. The distribution of agents recovered from patients reported through the notification system for food borne infections is different from that recorded in the central reference laboratory (Salmonella 77% of reported cases compared to 56% of all laboratory confirmed cases and Campylobacter and Yersinia 12% and 3% compared to 37% and 11%, respectively). The reason for these differences are not known.

Figure 4. Estimated sources for human salmonellosis in Denmark 1995

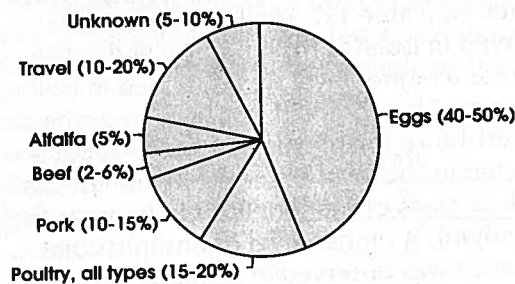


Table 8. Zoonoses in humans 1995 - incidence and trends of 5 and 10 years

Category	Zoonosis	Agent	1995		Five years trend					10 years	Note:
			Cases per 100,000 inh.	Registered cases	1994	1993	1992	1991	1990	1985	
I	Tuberculosis	<i>M. bovis</i>	0.17	9	5	7	9	3	5	0	a
	Brucellosis	<i>B. abortus/melitensis</i>	0	0	0	0	0	0	0	0	a
	Trichinosis	<i>T. spiralis/nativa</i>	0	0	0	0	0	0	0	0	a
	Salmonellosis	<i>Salmonella spp.</i>	70.3	3654	4276	3802	3379	2238	2112	1494	b
		<i>S. Enteritidis</i>	39.8	2070	1876	1093	1511	1013	562	726	
<i>S. Typhimurium</i>		16.3	848	1363	1193	1289	705	728	398		
	Other serotypes	14.2	736	1037	1516	579	520	822	370		
II	Campylobacteriosis	<i>C. coli/jejuni</i>	50	2601	2196	1776	1129	1261	1367	1457	
	Echinococcosis	<i>E. multilocularis/granulosus</i>	0	0	0	0	0	0	0	0	c
	Listeriosis	<i>L. monocytogenes</i>	0.6	29	23	27	24	32	37	22	d
	Rabies		0	0	0	0	0	0	0	0	e
	Toxoplasmosis	<i>T. gondii</i>	-	-	-	-	-	-	-	-	f
	Yersinia	<i>Y. enterocolitica</i>	15	779	643	710	901	929	967	1512	
	Coli infections	<i>E. coli</i>	0.5	28	35	28	33	49	32	111	
	O157	0.04	2	2	1	3	6	2	0		

Notes:

- Notification not mandatory. Cases of tuberculosis due to reactivation of latent infection in elderly.
- Only first isolations registered.
- Notification not mandatory. A few imported cases occur.
- Notification mandatory from 1986.
- Notification mandatory. No domestic or imported cases.
- Notification not mandatory. Approx. 1% of the population seroconvert annually.

Table 9. Serotype distribution of *Salmonella enterica* ssp. *enterica* from animals and humans in Denmark 1995

Serotype	Pigs	Pork	Cattle	Beef	Broilers	Layers	Pigeons	Turkeys	Ducks	Human
S. Agona	-	0.2	-	-	0.6	5.3	-	-	-	1.1
S. Albert	-	-	-	-	-	-	-	-	-	-
S. Anatum	-	-	-	-	0.5	-	-	-	6.3	0.3
S. Berta	-	-	-	-	0.6	-	-	2.7	-	0.2
S. Bredeney	-	-	-	1.9	-	-	-	-	-	0.1
S. Derby	2.1	4.7	-	-	-	-	-	-	-	0.2
S. Dublin	0.7	-	57.6	20.4	-	-	-	-	-	0.4
S. Enteritidis	0.9	-	3.1	1.9	0.4	31.6	-	-	12.5	56.7
S. Hadar	-	0.1	0.5	-	4.0	5.3	-	21.6	37.5	1.6
S. Havana	-	-	-	-	1.0	-	-	2.7	-	0.1
S. Heidelberg	0.2	0.1	-	-	-	-	-	5.4	-	0.4
S. Indiana	-	-	-	-	5.0	-	-	-	-	-
S. Infantis	2.8	6.4	-	3.7	18.3	21.1	-	-	-	0.9
S. Livingstone	0.5	0.8	-	-	-	-	-	5.4	-	-
S. Mbandaka	0.5	-	-	1.9	0.6	-	-	-	-	0.2
S. Montevideo	-	0.2	-	-	-	-	-	8.1	-	0.4
S. Newport	-	-	-	-	-	-	-	-	-	5.1
S. Panama	-	1.7	0.5	-	-	-	-	-	-	0.2
S. Saintpaul	-	0.4	-	-	-	-	-	9.7	-	0.4
S. Sandiego	-	0.2	-	-	-	-	-	-	-	1
S. Senftenberg	-	0.1	-	-	0.4	-	-	5.4	-	0.2
S. Tennessee	1.4	0.3	-	-	8.0	-	-	-	-	0.1
S. Typhimurium	86.2	79.6	36.6	46.3	18.8	21.1	100	13.5	18.8	23.2
S. Virchow	-	-	-	-	38.8	-	-	-	-	1.5
S. 4.12:b:-	2.8	1.0	-	24.1	18.4	15.8	-	2.7	31.3	-
S. 6.7:-:-	-	0.2	-	-	1.5	-	-	2.7	-	-
S. 1.9.12:-:-	-	-	1.0	-	-	-	-	-	-	-
Others	1.9	4.0	0.7	0.0	1.9	0.0	0.0	0.0	0.0	5.7
Total	100	100	100	100	100	100	100	100	100	100
Number typed	428	1000	191	54	1079	19	17	32	16	3654

Data: Danish Veterinary Laboratory, Danish Veterinary Service, Statens Seruminstitut

Table 10. Phage types of human *S. Enteritidis* (%) in Denmark 1995

Phage type	Total %
1	6
4	16
6	42
6a	5
8	14
21	1
25	2
34	3
RDNC	3
NT	7
Others	1
Total	100
Number typed	745

Data: Danish Veterinary Laboratory

Table 11. Phage type distribution (%) of *S. Typhimurium* from animals and humans in Denmark 1995

Phage type	Pigs	Pork	Cattle	Beef	Broilers	Humans
3	1	-	-	-	-	-
8	-	-	-	-	-	1
10	4.6	1.6	-	-	-	1
12	52	55.9	39.1	50	14	32
15a	1	3.9	-	-	-	5
17	5.2	4.6	8.7	-	-	1
41	-	-	4.3	-	1.7	1
66	9.2	10.2	7.2	-	2.7	9
110	2.9	1	4.3	-	23.4	3
120	1.6	-	2.9	-	2	3
135	3.3	2	15.9	-	47.1	13
177	1.6	1	-	40	-	2
193	6.5	6.3	8.7	-	4	4
U288	-	2	1.4	-	-	-
RDNC (12+18)	-	-	-	-	-	3
RDNC (12+22)	-	-	-	-	-	1
RDNC *	2.3	2	2.9	-	-	2
RDNC **	-	-	-	-	1	-
RDNC	3.6	3.6	4.3	10	1.7	9
NT	2	2.6	-	-	1.2	3
fi/ru	-	-	-	-	-	1
Others	4.2	3.3	0.3	0	-	6
Total	100	100	100	100	100	100
No. typed	306	304	69	10	401	401

Data: Danish Veterinary Laboratory

RDNC*: DT12 + phage 22

RDNC**: DT41 - phage 6

Table 12. Antibiotic resistant *Salmonella enterica* ssp. *enterica* isolated in Denmark in 1995

	Poultry	Cattle	Pig	Food stuffs in retail	Imported food stuffs in retail
Resistance to antibiotic	%	%	%	%	%
Amox + Cla	0	0	0	0	0
Ampicillin	6	1	4	8	33
Colistin	0	0	0	0	0
Enrofloxacin	0	0	0	0	0
Gentamycin	0	0	0	0	2
Neomycin	0	0	3	1	0
Spectinomycin	0	1	2	2	9
Streptomycin	1	4	8	9	23
Tetracycline	1	5	10	14	36
Tmp + Sulfa	0	1	5	5	20
% resistant (total)	7.9	6.1	18.4	17.8	37.9
% multi resistant ^{a)}	0	0	0.8	2.7	15.2
No of isolates	541	148	354	298	66

Data: Danish Veterinary Laboratory

a) More than 3 antibiotics

Table 13. Registered outbreaks of food-borne zoonotic diseases

Zoonotic agent	No. patients involved	Suspected source	Confirmed by culture
<i>S. Enteritidis</i>	6	Egg	No
do.	50	Egg/beef/pork	Yes
do.	9	Egg	Yes
do.	9	Egg	Yes
do.	12	Egg	No
do.	4	Egg	No
do.	2	Egg	No
do.	1	Chicken	No
do.	30	Egg	No
do.	59	Egg	No
do.	6	Duck	Yes
do.	40	Egg	No
<i>S. Newport</i>	approx. 150	Alfalfa sprouts	Yes
<i>S. Typhimurium</i>	3	Duck	(Yes)
do.	6	Beef	Yes

Total: 238 persons involved in 15 outbreaks

Data: Danish Food Agency

2. *Campylobacter jejuni/coli*

Poultry flocks and poultry at slaughter

The prevalence of thermotolerant *Campylobacter* (*C. jejuni*, *C. coli*, *C. lari*) in broilers was investigated in a survey by The Danish Veterinary Laboratory in May-June 1995. Cloacal swab samples from 101 broiler flocks were examined at four slaughter houses. 50.5% of the flocks were found to be infected with *Campylobacter*, predominantly *C. jejuni*. After slaughter neck skin samples from the same flocks were examined. At this stage the prevalence of *Campylobacter* was 25.7% (Table 2). In total, *Campylobacter* was detected in 53% of the flocks either before or after slaughter.

Pigs and cattle

A continuous programme for monitoring thermotolerant *Campylobacter* in pig and cattle herds by faecal samples collected at slaughter was initiated by the Danish Veterinary Laboratory at the end of 1995. The first results will appear in the 1996 report.

Products from retail outlets

In order to estimate the prevalence of thermotolerant *Campylobacter* species (*C. jejuni*, *C. coli* and *C. lari*) in samples of raw beef, pork and poultry from Danish retail outlets the National Food Agency and the 32 Municipal Food Control

Authorities performed a nationwide survey in the months of April and September 1995.

The results of the survey are incorporated in Tables 2, 4, and 5.

The results showed a prevalence between 0.5-2% of thermotolerant *Campylobacter* in raw beef and pork in both April and September 1995. Raw poultry (including imported products as well as products produced in Denmark) showed a higher proportion of contaminated samples increasing from 25.6 % in April to 42.4 % in September.

The observed increase in prevalence from 20.1 % in April to 41.4 % in September 1995 in Danish broilers and turkeys corresponded to the seasonal variation in incidence of human campylobacteriosis in the same periods. The prevalence in imported broilers and turkeys was, however constantly high over the period, i.e. 54.8 % in April and 46.3 % in September 1995.

The results of the survey indicated that the prevalence of thermotolerant *Campylobacter* spp. in raw beef and pork from Danish retail outlets was relatively low compared with poultry and with no seasonal variation. Broilers and turkeys produced in Denmark have a relatively high prevalence with a seasonal variation in the prevalence of thermotolerant *Campylobacter* spp. while imported poultry showed a constant high prevalence.

Campylobacteriosis in humans

The human incidence of campylobacteriosis increased from 2,196 cases in 1994 to 2,601 cases in 1995 (Table 8, Figure 5). Compared to 1992 (1,129 cases) the incidence has more than doubled over these 3 years, which is a major cause for concern. At the moment the reason for this increase is not known, but several different investigations have been initiated with the aim of tracing the sources of *Campylobacter* for humans and reducing the incidence of human campylobacteriosis in Denmark.

3. *Yersinia enterocolitica*

Yersiniosis in Denmark is almost exclusively caused by *Yersinia enterocolitica* serotype 0:3, biotype 4 identical to the *Yersinia* types isolated from Danish pigs and pork. More than 50% of human yersiniosis cases are seen in children below 5 years of age. The incidence of yersiniosis has decreased since 1985, however, from 1994 to 1995 a minor increase has been observed. The reason for this increase is not known. The primary source of *Yersinia* in Denmark is believed to be pigs. Most of the Danish slaughter pigs are assumed to harbour *Yersinia enterocolitica* serotype 0:3 biotype 4.

4. *Listeria monocytogenes*

Milk and milk products

A total of 1,765 samples of milk and milk products (primarily soft cheese) were tested for presence of *Listeria monocytogenes*. Thirtyfive (2.0%) samples were found to harbour *Listeria monocytogenes*. Twenty-nine of these originated from a single dairy plant.

Food from retail outlets

During the autumn of 1994 and the first half of 1995 an investigation of the occurrence of *L. monocytogenes* in Danish retail foods was carried out in a collaboration between the Municipal Food Control Authorities and the Danish Food Agency. The purpose of the investigation was to elucidate the presence, qualitatively as well as quantitatively, of *L. monocytogenes* in a wide variety of foods of animal and fish origin marketed in the retail sector.

A total of 2,010 samples were investigated using a qualitative technique, a semiquantitative technique and a quantitative technique (Table 14).

The highest frequency of contamination was found in raw meat (30.9%) and raw fish products (14.2%). Preserved, not heat treated, products of meat and fish were found contaminated in relatively high frequencies, 23.5% and 10.8%, respectively. Although heat treated meat products were contaminated in lower frequency than preserved meat products, the quantitative analysis showed that heat treated products more frequently reached high counts of *L. monocytogenes*. Prolonged shelf-life improved by e.g. vacuum-packing in connection with the lack of competing bacterial flora could be the explanation for this. A surprising observation was that minced meat often yielded high counts

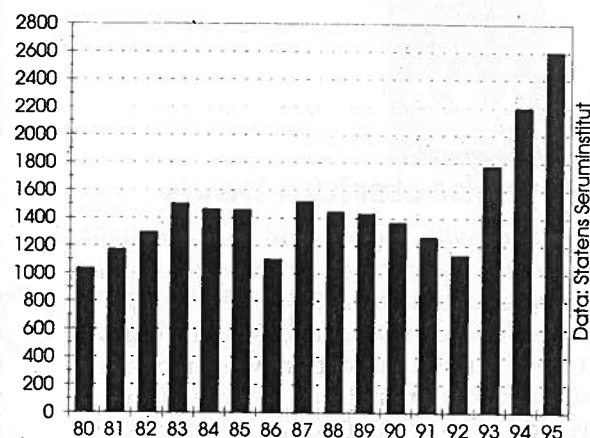


Figure 5. Registered number of cases of human campylobacteriosis in Denmark 1980-95

(above 100 *L. monocytogenes* per gramme), in spite of the short shelf-life of these products (24 hours acc. to Danish legislation). Use of raw materials of questionable microbiological quality for the production of minced meat might be the explanation for this. A quantitative analysis for *L. monocytogenes* may thus be used as a parameter for the evaluation of health risk as well as hygienic quality of the food.

5. *Escherichia coli* (EHEC)

The problem of zoonotic *E. coli* infections remains very low in Denmark and so far no outbreaks caused by EHEC have been recorded. The reason for this favourable situation is not entirely clear. VTEC producing *E. coli* 0:157 have been found sporadically in Danish cattle herds and on carcasses of newly slaughtered cattle. The actual prevalence of EHEC in production animals and in food products in Denmark is yet not sufficiently known. During 1996 a screening of fresh meat products from retail outlets will be carried out by the Danish Food Agency.

Table 14. Presence of *Listeria monocytogenes* (*L.m.*) in Danish retail foods

	No. of samples (%) L.m. positive in a 25 gramme sample	No. of samples (%) with more than 10 L.m. per gramme	No. of samples (%) with more than 100 L.m. per gramme	No. of samples investigated
Raw meat	106 (30.9%)	42 (12.6%)	12 (3.6%)	343
Heat treated meat products	39 (9.0%)	22 (5.2%)	10 (2.4%)	431
PatÉ	6 (1.8%)	1 (0.3%)	1 (0.3%)	341
Preserved meat products (not heat treated)	77 (23.5%)	8 (2.4%)	2 (0.6%)	328
Raw fish	33 (14.2%)	7 (3.2%)	1 (0.5%)	232
Preserved fish products (not heat treated)	35 (10.8%)	17 (5.1%)	6 (1.8%)	335
Total	296 (14.7%)	97 (4.9%)	32 (1.6%)	2010

Data: Danish Food Agency

6. *Mycobacterium bovis*

In accordance with Commission Decision 80/984/EEC, Denmark has been regarded officially free from bovine tuberculosis (TB) since 1980. TB is a notifiable disease in Denmark. Monitoring is performed by meat inspection, which means that all slaughter animals are examined for lesions indicative of TB. Bulls at AI-stations are subject to pre-entry and annual intradermal tuberculin testing. The last case of TB in cattle was diagnosed in 1988.

In 1988-89 13 deer farms were found to be infected with bovine tuberculosis and until 1994 another 3 farms were found to be affected. Eradication measures were taken and restrictions have been lifted on all 16 farms. In 1995 no deer farm was known to be infected with TB. Surveillance by testing or meat control is still performed in all deer farms.

In 1995 9 cases (0.17 cases per 100,000 inhabitants) of human tuberculosis caused by *M. bovis* were registered. All cases were seen in elderly people, the youngest being 71 years old. No cases of human tuberculosis caused by *Mycobacterium bovis* was associated with transmission from animals or food in Denmark. The few cases registered each year are predominantly seen in elderly and regarded as reactivation of latent infection acquired years ago before the eradication of bovine TB in cattle. Bovine tuberculosis in humans is no longer a notifiable disease in Denmark.

7. *Brucella abortus/melitensis*

In accordance with Commission Decision 79/837/EEC Denmark has been regarded officially free from brucellosis in cattle since 1979. Brucellosis is a notifiable disease, and clusters of abortions are notifiable. Monitoring is performed by examination of abortion material. Brucellosis in cattle has not been diagnosed since 1962. In 1994 one case of *B. suis* biotype 2 occurred in a herd of free range sows and boars; no cases occurred in pigs in 1995. Bulls and boars are subject to pre-entry serological examination before entering AI-stations. After entering, bulls are serologically examined annually and boars are tested at least every 18 months and before they leave the station.

No domestically acquired human cases but a few imported cases occur each year. The infection in humans is not notifiable in Denmark.

8. *Trichinella spiralis/nativa*

All carcasses of slaughter pigs are examined for *Trichinella* in accordance with Council Directive 64/433/EEC, Annex I, chapter VIII. *Trichinella* has not been found in Danish pigs since 1930. During 1995, 19,431,485 pigs were examined at slaughter with a negative result. In addition, slaughtered wild boars must be examined and in 1995 a total of 1,484 wild boars were examined and not found to contain *Trichinella*. 776 horses which were slaughtered at export authorized slaughterhouses approved for intra-community trade were examined with a negative result during 1995.

A national programme for screening of *Trichinella* infections in wildliving foxes was initiated in 1995. At the end of the year a large number of forelegs from foxes had been submitted for examination, but only 280 of the samples received have so far been subjected to laboratory examination, all with a negative result.

No domestically acquired cases of human trichinosis were recorded in 1995. A few imported cases occur annually. The infection in humans is not notifiable.

9. *Echinococcus multilocularis/granulosus*

Echinococcus granulosus infections in all animals are reportable. Surveillance for *Echinococcus* is performed through meat inspection. In 1995, no cases of *Echinococcus* infections were reported.

No domestically acquired human cases but a few imported cases occur each year. The infection in humans is not a notifiable disease in Denmark.

10. *Toxoplasma gondii*

Toxoplasmosis is not a notifiable disease in Denmark, and the incidence of clinical toxoplasmosis in humans is unknown. The most important source of infection is presumably ingestion of food or water contaminated with oocysts from cat faeces. It is estimated that about 1% of the cat population at a given time is shedding oocysts of *T. gondii*, and that 33% of all cats are seropositive. In 1992 an investigation of 4,016 slaughter pigs showed, that 3.1% were seropositive, while an investigation of 807 gilts and sows from 30 herds showed an average seroprevalence of 11.9%, where the seroprevalence is increased with the mean age of the population investigated.