European Food Safety Authority

ZOONOSES MONITORING

ICELAND

The Report referred to in Article 9 of Directive 2003/99/EC

TRENDS AND SOURCES OF ZOONOSES AND ZOONOTIC AGENTS IN HUMANS, FOODSTUFFS, ANIMALS AND FEEDINGSTUFFS

including information on foodborne outbreaks, antimicrobial resistance in zoonotic agents and some pathogenic microbiological agents.

IN 2011

INFORMATION ON THE REPORTING AND MONITORING SYSTEM

Country: Iceland

Reporting Year: 2011

Laboratory name	Description	Contribution
Icelandic Food and Veterinary Authority, MAST	The Icelandic Food and Veterinary Authority (MAST) is the competent authority for the purpose of Directive 2003/99/EC of the European Parliament and of the Council. MAST carries out administration, surveillance, training and services to fisheries, agriculture, businesses and consumers in order to promote animal health and welfare, plant health and safety of food.	Data and text. The reporting officer is employed at MAST.
Institute for Experimental Pathology, Keldur	Institute for Experimental Pathology, Keldur conducts research and supplies research based advisory support to the Icelandic authorities concerning animal health. They provide diagnostic and analytical services and cover all disciplines relating to infectious diseases: Pathology, bacteriology, virology, parasitology, immunology vaccinology and serology. Keldur serves as a national reference laboratory.	Data
Matis ltd., Matís ohf	Matis is an independent research institute on food and Biotechnology. Matis serves as a testing laboratory for food and feed.	Data
Syni Laboratory service, Sýni ehf	Syni Laboratory Service Ltd. is a privately owned company with a testing laboratory for food and feed.	Data

INFORMATION ON THE REPORTING AND MONITORING SYSTEM

Laboratory name	Description	Contribution
ProMat, Rannsóknaþjónustan ProMat ehf	ProMat Laboratory service Ltd is a privately owned testing laboratory for fish and food.	Data

PREFACE

This report is submitted to the European Commission in accordance with Article 9 of Council Directive 2003/99/ EC*. The information has also been forwarded to the European Food Safety Authority (EFSA).

The report contains information on trends and sources of zoonoses and zoonotic agents in Iceland during the year 2011 .

The information covers the occurrence of these diseases and agents in humans, animals, foodstuffs and in some cases also in feedingstuffs. In addition the report includes data on antimicrobial resistance in some zoonotic agents and commensal bacteria as well as information on epidemiological investigations of foodborne outbreaks. Complementary data on susceptible animal populations in the country is also given. The information given covers both zoonoses that are important for the public health in the whole European Community as well as zoonoses, which are relevant on the basis of the national epidemiological situation.

The report describes the monitoring systems in place and the prevention and control strategies applied in the country. For some zoonoses this monitoring is based on legal requirements laid down by the Community Legislation, while for the other zoonoses national approaches are applied.

The report presents the results of the examinations carried out in the reporting year. A national evaluation of the epidemiological situation, with special reference to trends and sources of zoonotic infections, is given. Whenever possible, the relevance of findings in foodstuffs and animals to zoonoses cases in humans is evaluated.

The information covered by this report is used in the annual Community Summary Report on zoonoses that is published each year by EFSA.

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* Directive 2003/ 99/ EC of the European Parliament and of the Council of 12 December 2003 on the monitoring of zoonoses and zoonotic agents, amending Decision 90/ 424/ EEC and repealing Council Directive 92/ 117/ EEC, OJ L 325, 17.11.2003, p. 31

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1. ANIMAL POPULATIONS

The relevance of the findings on zoonoses and zoonotic agents has to be related to the size and nature of the animal population in the country.

A. Information on susceptible animal population

Sources of information

Information is taken from the livestock database BUSTOFN where all animals and animal owners are registered. The Icelandic Food and Veterinary Authority (MAST) is responsible for the database. Information regarding slaughtered animals comes from the register of slaughtered animals which is hosted at the Farmers Association. Information for number of poultry for meat production comes from the Veterinary Officer for Poultry diseases.

Dates the figures relate to and the content of the figures

The figures for livestock and herds relate to the year 2011 (31.12.2011). As not all the animal groups mentioned exist in Iceland there are no figures on some animal groups in the report. For Poultry the number of flocks is cumulative for the year 2011.

Definitions used for different types of animals, herds, flocks and holdings as well as the types covered by the information

Herd means an animal or group of animals kept on a holding as an epidemiological unit. In Iceland, there is generally only one herd of the same animal species execpt for poultry.

National evaluation of the numbers of susceptible population and trends in these figures

When evaluating the number of susceptible populations the figures are relatively accurate, considering that these figures have been confirmed during annual on the spot controls for all herds. Livestock officers are responsible for confirming the accuracy of the figures for each animal owner. There has been a general downward trend in the figures for dairy cows, there are fewer holdings but at the same time each holding is getting bigger. Population numbers for sheep and horses have been stable for the past decade.

Geographical distribution and size distribution of the herds, flocks and holdings

All existing animal groups in Iceland are relatively evenly spread around the agricultural lowland areas. There are no herds or holdings in the highlands, which cover over 80 % of the island. In the summer, from June to September, the flocks of sheep and herds of horses are grazing in the highlands.

Table Susceptible animal populations

* Only if different than current reporting year

		Number of herds or flocks		Number of slaughtered animals		Livestock numbers (live animals)		Number of holdings	
Animal species	Category of animals	Data	Year*	Data	Year*	Data	Year*	Data	Year*
Cattle (bovine animals)	meat production animals	193		9710		7190		193	
	dairy cows and heifers	686		8104		60625		686	
	calves (under 1 year)	19		3304		145		19	
	mixed herds	22				4813		22	
	- in total	920		21118		72773		920	
Deer	farmed - in total	0		0		0		0	
Ducks	meat production flocks	26		6396		1130		80	
	parent breeding flocks	1						1	
	- in total					1130		81	
Gallus gallus (fowl)	breeding flocks for egg production line - in total	11						4	
	breeding flocks for meat production line - in total	39		49275				8	
	parent breeding flocks for egg production line	11						4	
	parent breeding flocks for meat production line	39		49275				8	

Table Susceptible animal populations

Animal species	Category of animals	Number of herds or flocks		Number of slaughtered animals		Livestock numbers (live animals)		Number of holdings	
		Data	Year*	Data	Year*	Data	Year*	Data	Year*
Gallus gallus (fowl)	laying hens	420		15996		216967		393	
	broilers	637		4657836				27	
	- in total	1107		4723107				432	
Geese	meat production flocks					213		23	
	- in total					213		23	
Goats	meat production animals [1]								
	animals under 1 year [2]								
	animals over 1 year [3]								
	milk goats [4]								
	mixed herds [5]								
	- in total	76				813		76	
Pigs	fattening pigs [6]	15		74532		33394		15	
	breeding animals - unspecified - sows and gilts	4		1289		1420		4	
	- in total	19		75821		34814		19	

Table Susceptible animal populations

		Number of herds or flocks		Number of slaughtered animals		Livestock numbers (live animals)		Number of holdings	
Animal species	Category of animals	Data	Year*	Data	Year*	Data	Year*	Data	Year*
Sheep	meat production animals	2642		45710		473941		2642	
	animals under 1 year (lambs)			536100					
	- in total	2642		581810		473941		2642	
Solipeds, domestic	horses - in total	2544		7038		78277		2544	
Turkeys	meat production flocks	22		40328				5	
	parent breeding flocks	4		822				2	
	mixed flocks/holdings							4	
	- in total							11	
Wild boars	farmed - in total	0		0		0		0	

Comments:

[1)] NA

[2)] NA

[3)] NA

[4)] NA

[5)] NA

Table Susceptible animal populations

Comments:

[6)] Includes mixed and fattening herds

2. INFORMATION ON SPECIFIC ZOONOSES AND ZOONOTIC AGENTS

Zoonoses are diseases or infections, which are naturally transmissible directly or indirectly between animals and humans. Foodstuffs serve often as vehicles of zoonotic infections. Zoonotic agents cover viruses, bacteria, fungi, parasites or other biological entities that are likely to cause zoonoses.

2.1 SALMONELLOSIS

2.1.1 General evaluation of the national situation

A. General evaluation

History of the disease and/or infection in the country

Salmonella is endemic in the pig production but prevalence of Salmonella on pig carcasses has been low since 2007 (0,5 – 2,7%) except for the year 2009 where the prevalence rose to 11,2%.

The situation regarding Salmonella in the poultry meat production has been very good, with prevalence under 1% in poultry flocks for many years and 0% prevalence for three consecutive years (2005 – 2007). In 2009 – 2011, however, an increase in positive poultry flocks was seen. Salmonella in breeding flocks (Gallus gallus) has never been confirmed in the last decade.

Salmonella infections in sheep holdings have not been investigated but clinical outbreaks have sporadically occurred.

A study in 2010 on Salmonella in bovine animals revealed very low prevalence (<0,5%) with no samples positive.

As for sheep, sporadic clinical cases and outbreaks of Salmonella have occurred in horses.

The situation regarding Salmonella in pork and poultry products is considered very good. When meat products have been sampled at retail Salmonella is rarely found.

Spread of Salmonella into the pig production has likely occurred by raw feed materials. PFGE investigations indicate that some Salmonella serotypes have spread into poultry production with compound feed but the mechanism of spread is not known.

National evaluation of the recent situation, the trends and sources of infection

Since 2009 total cases of human salmonellosis have been relatively few. Numbers of cases acquired abroad have gone down most likely because of less travelling of Icelanders after the past few years. The number of domestic cases was relatively stable in this same period.

In the last fifteen years i.e. from 1997 - 2011 the Directorate of Health (Chief Epidemiologist for Iceland) has registered 1.800 cases of human salmonellosis. Of these 1.800 cases, 1.148 (63,8%) were acquired abroad and 489 (27,2%) were of domestic origin. Origin of the other 163 (9,1%) cases is unknown. Domestic cases pr. 100.000 inhabitants in this same period vary from 1,8 to 10,7 with one exception where in the year 2000, incidence of domestic cases were 81,5 mainly caused by a food borne outbreak.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

Because of very strict control programmes for reducing salmonella in the pig and poultry production and

low numbers of human cases of salmonellosis, domestic food products of animal origin are considered to represent a small risk to the consumer in regard to Salmonella. This assumption is supported by the experience in 2009 and 2010 where the prevalence of Salmonella in pig and poultry meat production rose significantly but where the prevalence of human cases of salmonellosis did not alter in the same direction. Instead the opposite development was observed.

Because of changes (see recent actions) in the feed production in 2010 spread of Salmonella seems not to be as important as before. Instead, permanent local infections in some premises seem to be the main cause for maintaining the prevalence in the poultry flocks at approximately 1 – 2%.

Recent actions taken to control the zoonoses

Heat treatment of raw soya material (2010) before shipment to pig holdings and replacing an old feed mill (2010) with a new one with excellent bio security are two major factors that have contributed to less spread of Salmonella by feed.

2.1.2 Salmonella in foodstuffs

A. Salmonella spp. in pig meat and products thereof

Monitoring system

Sampling strategy

At slaughterhouse and cutting plant

The information needed is whether carcasses are contaminated with Salmonella or not. Therefore are all slaughter batches from all holdings tested for Salmonella. The sampling is a part of permanent control programme and is objective, official and performed by the CA (MAST).

Samples are taken from carcasses after cooling where the number of samples depend on the size of the slaughter batch.

At retail

Depend on the survey.

Frequency of the sampling

At slaughterhouse and cutting plant

Every herd is sampled at each slaughter. From every herd ten randomly chosen carcasses from the slaughter batch are swabbed if 40 or fewer pigs are slaughtered, twenty carcasses are swabbed if 41 - 120 pigs are slaughtered and thirty carcasses are swabbed if more than 120 pigs are slaughtered. By this number of samples it can be declared by 95% confidence level that at least one positive sample will be detected in the batch if the prevalence in the batch is 10 – 15% or higher.

At retail

Depend on the survey.

Type of specimen taken

At slaughterhouse and cutting plant

Surface of carcass

At retail

Depends on the survey.

Methods of sampling (description of sampling techniques)

At slaughterhouse and cutting plant

At slaughtering, the pig carcasses are split into two parts along the vertebrate. After cooling both carcass parts are swabbed in three designated areas. Two cotton swabs are used – one for each carcass part. Two of the three areas on each part cover approx. 10 x 10 cm. The third area covers approx. 200 cm2. The three different areas on each side of the carcass cover the following sites:

Area I: Anus region, inside of the thigh and the pelvis region
Area II: The cut surface of the breast and abdomen, underbelly
Area III: Inside the cranial part of thorax and the adjacent transected bones/ribs

Swabs from 10 carcasses are pooled together in on sample.

At retail

Depends on the survey.

Definition of positive finding

At slaughterhouse and cutting plant

The swabs tests are Tecra Rapid tests (antibody/antigen test). A positive test according to the protocol for the test and before confirmation by culturing, is regarded as positive for Salmonella. Confirmation by culturing is not needed, but at least one swab from each slaughter batch is serotyped and tested for antimicrobial resistance. If a positive Tecra test is negative by bacteriological culturing, the result has no influence on actions already taken regarding next slaughter from the respective herd.

At retail

A sample is considered positive when Salmonella has been isolated.

Diagnostic/analytical methods used

At slaughterhouse and cutting plant

Salmonella Tecra Unique Rapid Test. (Enrichment immunocapture immunoenrichment and detection steps)
Bacteriological method: NMKL 187:2007
Bacteriological method: NMKL 71:1999

At retail

Depends on survey.

Preventive measures in place

Sanitary slaughtering is performed when herds are categorised as level 3 herds. Organs from pigs originating from level 2 or 3 herds are considered not fit for processing or consumption.

Control program/mechanisms

The control program/strategies in place

The mandatory national control programme for Salmonella in pigs is approved by the Competent Authority, MAST. The aim of the programme is to prevent salmonella in pork and thereby mitigate the risk of human salmonellosis.

The surveillance programme is constructed to monitor salmonella infections at farm level by measuring antibodies against Salmonella in meat juice test, to survey salmonella contamination on pig carcasses at slaughtering and to monitor Salmonella serotypes in faecal and swab samples. Salmonella serotypes are also tested for antimicrobial resistance.

Measures in case of the positive findings or single cases

Finding one positive sample from a level 1 herd initiates reactions. In case of a positive sample all carcasses from the respective herd must be swabbed at next slaughter and quarantined whilst waiting for the results from the swab test. All positive carcasses must be heat treated before entering the market.

All carcasses from level 2 and 3 herds are swabbed and quarantined at the slaughterhouse and cannot enter the market unless swabs are negative. Carcasses positive for Salmonella must be heat treated.

Notification system in place

Salmonella is a notifiable disease, according to national legislation on animal diseases No. 25/1993 and according to the national Food Law No. 93/1995. The Competent Authority, MAST, receives all results from the respective laboratories regarding Salmonella testing (including serotyping and antimicrobial

resistance) on samples from pig production and slaughtering.

Results of the investigation

Swabs taken at the slaughterhouses were 1,3% positive for Salmonella. In swab samples Salmonella Sandiego, Salmonella Worthington and Salmonella Enteritidis were found. This is the first time Salmonella Enteritidis is found in samples related to livestock in Iceland.

National evaluation of the recent situation, the trends and sources of infection

The prevalence for Salmonella positive swab samples was 1,1%, 0,5%, 1,4% in 2006, 2007 and 2008. The prevalence rose to 11,2% in 2009 but declined in the two consecutive years i.e. in 2010 and 2011 to 2,7% and 1,3% respectively. Despite of the increase in Salmonella in the pig production and on pig carcasses salmonellosis in humans in the same period did not alter in the same direction. On the contrary domestic cases of salmonellosis in humans were fewer in 2009 and 2010 compared to domestic cases in the previous years.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

Salmonella on pig carcasses seems not to be a major source for human infections.

Table Salmonella in poultry meat and products thereof

	Source of information	Sampling strategy	Sampler	Sample type	Sample Origin	Sampling unit	Sample weight	Units tested	Total units positive for Salmonella	S. Enteritidis	S. Typhimurium
Meat from broilers (Gallus gallus) - carcase - at slaughterhouse - Surveillance	Keldur	Census	Official sampling	food sample > neck skin		Batch	25 g	695	8		
Meat from turkey - carcase - at slaughterhouse - Surveillance	Keldur	Census	Official sampling	food sample > neck skin		Batch	25 g	63	0		
Meat from duck - carcase - at slaughterhouse - Surveillance	Keldur	Census	Official sampling	food sample > neck skin		Batch	25 g	24	1		

	Salmonella spp., unspecified	S. Infantis	S. Montevideo
Meat from broilers (Gallus gallus) - carcase - at slaughterhouse - Surveillance		8	
Meat from turkey - carcase - at slaughterhouse - Surveillance			
Meat from duck - carcase - at slaughterhouse - Surveillance			1

Table Salmonella in red meat and products thereof

	Source of information	Sampling strategy	Sampler	Sample type	Sample Origin	Sampling unit	Sample weight	Units tested	Total units positive for Salmonella	S. Enteritidis	S. Typhimurium
Meat from pig - carcase - at slaughterhouse - Surveillance	MAST	Objective sampling	Official sampling	food sample > carcass swabs		Single	2 x 2 x 100cm2 + 2 x 1 x 200 cm2.	1524	9		
Meat from pig - carcase - chilled - at slaughterhouse - Surveillance	MAST	Census	Official sampling	food sample > carcass swabs		Batch	2 x 2 x 100cm2 + 2 x 1 x 200 cm2.	998	23	1	

	Salmonella spp., unspecified	S. Sandiego	S. Worthington
Meat from pig - carcase - at slaughterhouse - Surveillance	6	2	1
Meat from pig - carcase - chilled - at slaughterhouse - Surveillance	22		

2.1.3 Salmonella in animals

A. Salmonella spp. in Gallus Gallus - breeding flocks

Monitoring system

Sampling strategy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

The monitoring of salmonella in breeding flocks of Gallus gallus is applied to the whole country. Every breeding flock consisting of 250 animals or more is sampled. During primary production samples are both taken by the food buisness operator (FBO) and by the competent authority (CA) in accordance with the national control programme.

According to import regulations, breeder flocks are also under surveillance at the time of rearing while they are in quarantine. At the time of rearing samples are taken at the farm, and during production samples are taken at the hatchery. When a breeder flock is slaughtered official samples are taken from each slaughter batch at the time of slaughter, after evisceration but before chilling. The sampling strategy is according to national requirements that were implemented in 2001 and 2002 and a national control programme that was first implemented in 2008 in accordance with reg. (EC) no. 1003/2005.

In Iceland there are only parent flocks.

Frequency of the sampling

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Every flock is sampled

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

At the age of 4 weeks and again 2 weeks before moving to the laying phase.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Every 2 weeks.

Type of specimen taken

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Hatched eggs

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Socks/ boot swabs

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Hatched eggs (eggshell) are sampled at the hatchery, except for one producer, where sock samples were taken at farm (1 farm with breeding flocks in 7 houses).

Methods of sampling (description of sampling techniques)

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

From each breeding flock (paternal line and maternal line separately) one sample is taken during hatching. The pooled sample consists of 10 g of broken eggshells taken from a total of 25 separate hatcher baskets, which in total is at least 250g of broken eggshells.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

From each breeding flock two pairs of boot swabs are collected and pooled into one sample, both at the age of 4 weeks and two weeks before moving to the laying phase.

Breeding flocks: Production period

From each breeding flock one sample is taken at the hatchery. The pooled sample consists of 10 g of broken eggshells taken from a total of 25 separate hatcher baskets, which in total is at least 250g of broken eggshells. If eggs from a flock are incubated less then on a fortnight basis, a sample is taken each time during hatching.

From flocks from one producer where monitoring took place at farm, from each flock, 5 pairs of sock samples were taken, pooled into two samples.

The official samples taken at the beginning and the end of the laying phase consisted of either 5 pairs of bootswabs or one pair of bootswabs and one dust sample of at least 100g of dust, taken at farm level. Official samples were also taken at the hatchery according to the sampling technique described above.

Case definition

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

A sample positive for salmonella spp.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

A sample positive for salmonella spp.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

A sample positive for Salmonella spp.. A positive sample always has to be confirmed by official sampling at the farm whether it was first found in an official sample or a sample taken by the FBO.

Diagnostic/analytical methods used

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Bacteriological method: NMKL No 71:1999

Vaccination policy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Vaccination of poultry flocks against salmonella is not practiced and there is not intention that it will become part of control strategies.

Other preventive measures than vaccination in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Preventative measures include specific requirements regarding biosecurity in accordance with national legislation.

Preventative treatment with antibiotics is not practiced in Iceland, and although the treatment is not specifically prohibited it is however against Icelandic policy regarding the use of antimicrobials.

Control program/mechanisms

The control program/strategies in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

A national control programme was published by the Competent Authority on 1.11.2008 for the control of salmonella in poultry. The control programme was developed according to reg. (EC) no. 1003/2005. It includes sampling at rearing (day old chicks, at 4 weeks of age and 2 weeks before moving to the laying house) and sampling every other week during production at the hatchery.

The industry bears the cost of the sampling directly for samples taken from breeder flocks of laying hens, and indirectly if taken from breeder flocks of broilers as it is then paid through a fee taken per kg of slaughtered meat.

According to reg. (IS) no. 688/2002 and the surveillance strategies implemented by the former Chief Veterinary Office, official samples are taken from each slaughter batch by taking one pooled sample of 50 neck skins. The costs are covered through a fee taken per kg of slaughtered meat.

According to Icelandic legal act no. 25/1993 it is prohibited to import poultry to Iceland. Exceptions can however be given for hatching eggs or day old chicks for parents, if they are submitted to quarantine upon entry. A negative result for Salmonella spp. from grandparent flock is a necessary requirement before permission is given for a shipment of hatching eggs or day old chicks to be imported to Iceland

Measures in case of the positive findings or single cases

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

According to Icelandic legal act no. 25/1993 and reg. (IS) no. 665/2001 birds from a flock that has been tested positive may not be moved from the farm. It is forbidden to hatch eggs from a positive parent flock. According to reg. (IS) no. 688/2002 a positive flock cannot be sent to the slaughterhouse and must be culled at the farm.

Notification system in place

Salmonella is a notifiable disease according to Icelandic legal act nr. 25/1993.
The laboratory sends an immediate notification to the CA when there is a positive salmonella finding.

Results of the investigation

No Salmonella spp. was found in breeding flocks of Gallus gallus.

National evaluation of the recent situation, the trends and sources of infection

No Salmonella spp. was found in breeding flocks of Gallus gallus.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

No salmonella spp. was found in breeding flocks of Gallus gallus and they are not considered as a source of infection in other animals, foodstuffs or humans.

B. Salmonella spp. in Gallus Gallus - broiler flocks

Monitoring system

Sampling strategy

Broiler flocks

The sampling strategy is according to a control programme that was implemented in 2008 in accordance with reg. (EC) no. 646/2007 and it applies to all of Iceland.

Every broiler flock is sampled at the farm less than 3 weeks prior to slaughter. Samples are taken by the food business operator (FBO). Official samples are taken by the competent authority from 10% of all broiler farms every year. Samples are taken from one flock per farm. Official veterinarians also take samples from each slaughter batch (slaughter flock) at the time of slaughter, after evisceration but before chilling.

Frequency of the sampling

Broiler flocks: Before slaughter at farm

3 weeks prior to slaughter

Broiler flocks: At slaughter (flock based approach)

Every flock is sampled

Type of specimen taken

Broiler flocks: Before slaughter at farm

Other: Boot/sock swabs or fecal samples

Broiler flocks: At slaughter (flock based approach)

Neck skin

Methods of sampling (description of sampling techniques)

Broiler flocks: Before slaughter at farm

From each broiler flock two pairs of boot swabs are collected and pooled into one sample. Occasionally, one pooled sample consisting of 60 fecal samples is taken instead of boot swabs.

Broiler flocks: At slaughter (flock based approach)

From each slaughter flock one pooled sample consisting of 50 neck skin samples is taken, with each neck skin sample weighting between 3 - 5 g.

Case definition

Broiler flocks: Before slaughter at farm

A flock is considered positive when Salmonella spp. is found in a sample. According to the national control programme, no confirming samples are taken except as a part of the FBO’s own controls. When salmonella is not found in two subsequent samples taken from the same flock as the positive sample, given that the latest sample was taken by an official veterinarian, the flock is considered to be negative for salmonella.

Broiler flocks: At slaughter (flock based approach)

A sample positive for Salmonella spp.

Diagnostic/analytical methods used

Broiler flocks: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Broiler flocks: At slaughter (flock based approach)

Bacteriological method: NMKL No 71:1999

Vaccination policy

Broiler flocks

Vaccination of poultryflocks against salmonella is not practiced in Iceland and there are no intentions for it to become a part of control strategies.

Other preventive measures than vaccination in place

Broiler flocks

Preventative measures include specific requirements regarding biosecurity in accordance with national legislation.
Preventative treatment with antibiotics is not practiced in Iceland, and although the treatment is not specifically prohibited it is however against Icelandic policy regarding the use of antimicrobials.

Control program/mechanisms

The control program/strategies in place

Broiler flocks

A national control programme was published by the Competent Authority on 1.11.2008 for the control of salmonella in poultry. The control programme was developed according to reg. (EC) no. 646/2007. It describes sampling of each broiler flock at the farm three weeks prior to slaughter.

According to reg. (IS) no. 688/2002 and according to the surveillance strategies implemented by the former Chief Veterinary Office, official samples are taken from each slaughter batch through one pooled sample consisting of 50 neck skins.

The industry bears the cost of sampling directly for samples taken at the farm, and then indirectly for samples taken at the time of slaughter through a fee taken per kg of slaughtered poultry.

According to Icelandic legal act no. 25/1993 it is prohibited to import poultry to Iceland. Exception can however be given when quarantine is possible. No live broilers and no broiler hatching eggs are imported to Iceland.

Measures in case of the positive findings or single cases

Broiler flocks: Before slaughter at farm

According Icelandic legal act no. 25/1993 and reg. (IS) no. 665/2001 birds from a flock that has been tested positive may not be moved from the farm. According to reg. (IS) no. 688/2002 a positive flock cannot be sent to the slaughterhouse and must be culled at the farm.

Broiler flocks: At slaughter (flock based approach)

According to reg. (IS) no. 688/2002 all meat from a slaughter flock with a positive neck skin sample has to be destroyed or heat treated before further distribution. All raw meat from the flock that has already been distributed is also withdrawn and recalled from the market.

Notification system in place

Salmonella is a notifiable disease according to Icelandic legal act no. 25/1993.
The laboratory sends an immediate notification to the CA when there is a positive salmonella finding.

Results of the investigation

Prevalence of salmonella has been low in the last years. Since broiler flocks have been sampled both before slaughter and at the time of slaughter since the year 2001, the implementation of the new sampling strategy in 2008 had no affect on the information regarding salmonella in broiler flocks.

National evaluation of the recent situation, the trends and sources of infection

Since 1997 salmonella prevalence in broiler flocks at the farm level has been below 1%. After 2008 however, the prevalence of salmonella in broiler flocks rose and reached a peak in 2010.
In 2010 and 2011 the prevalence rose to 5,2% and 2,2%, respectively. The source of the contamination was partly believed to be contaminated feedstuff, but in some cases flocks in previously uninfected houses got contaminated through cross contamination with equipment and/or staff. In some cases salmonella was repeatedly found in previously contaminated houses.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

In Iceland it is forbidden to slaughter salmonella positive poultry flocks. Therefore, the main sources of contaminated poultry meat are flocks with a negative pre-slaughter sample but a positive sample at the time of slaughter. Cross contamination between negative and positive flocks at the slaughterhouse could be a possible source. Salmonella prevalence in slaughter flocks has been far below 1% since sampling started in 1998 and up until 2010 (except for 2001 when prevalence was 1,8%). In 2010 and 2011, prevalence in slaughter flocks rose to 4,1% and 1,3%, respectively. No S. enteritidis or S. typhimurium were however found in broilers during this time and there have been no reports or indications of human infections from infected broilers in the past two years.

C. Salmonella spp. in Gallus Gallus - flocks of laying hens

Monitoring system

Sampling strategy

Laying hens flocks

The monitoring of salmonella in laying hens covers the whole country. All flocks of more than 50 laying hens are under surveillance.

At primary production the samples are taken by the Food Buisness Operator (FBO). Official samples are also taken by the Competent Authority (CA) once a year from each farm with more than 1000 hens. Samples are taken one flock per farm.

Samples are taken twice from each rearing flock, twice during production and also at the end of the production period, if the flock is to be sent to the slaughterhouse.

All samples from primary production are taken at the farm. If a flock of laying hens is slaughtered, official samples are taken from each slaughter batch at the time of slaughter, after evisceration but before chilling. The sampling strategy is according to national requirements that were implemented in 2001 and 2002 and a national control programme that was first implemented in 2008 in accordance with reg. (EC) no. 1003/2005.

Frequency of the sampling

Laying hens: Rearing period

At the age of 2-4 weeks, and at the age of 12 - 15 weeks.

Laying hens: Production period

Every 15 weeks.

Laying hens: Before slaughter at farm

2 weeks prior to slaughter.

Laying hens: At slaughter

Every flock is sampled

Type of specimen taken

Laying hens: Rearing period

Faeces

Laying hens: Production period

Faeces

Laying hens: Before slaughter at farm

Faeces

Laying hens: At slaughter

Neck skin

Methods of sampling (description of sampling techniques)

Laying hens: Rearing period

A pooled sample consisting of 60 fecal samples.

Laying hens: Production period

A pooled sample consisting of 60 fecal samples.
Official samples: one pooled sample consisting of 150 g of fecal samples, or one pair of boot swabs and 1 x 100g of dust sample, respectively.

Laying hens: Before slaughter at farm

A pooled sample consisting of 60 fecal samples.

Laying hens: At slaughter

One pooled sample consisting of 50 neck skin samples, each neck skin sample weighting between 3-5 g.

Case definition

Laying hens: Rearing period

A sample positive for Salmonella spp.

Laying hens: Production period

Fecal and/or dust sample positive for Salmonella spp. If confirmation samples are taken (comprising 3000 eggs with shells) and those samples are negative, the flock is considered to be negative.

Laying hens: Before slaughter at farm

A sample positive for Salmonella spp.

Laying hens: At slaughter

A sample positive for Salmonella spp.

Diagnostic/analytical methods used

Laying hens: Rearing period

Bacteriological method: NMKL No 71:1999

Laying hens: Production period

Bacteriological method: NMKL No 71:1999

Laying hens: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Laying hens: At slaughter

Bacteriological method: NMKL No 71:1999

Vaccination policy

Laying hens flocks

Vaccination of poultry flocks against salmonella is not practiced and there is not intention that it will become part of control strategies.

Other preventive measures than vaccination in place

Laying hens flocks

Preventative measures include specific requirements regarding biosecurity in accordance with national legislation.
Preventative treatment with antibiotics is not practiced in Iceland, and although the treatment is not specifically prohibited it is however against Icelandic policy regarding the use of antimicrobials.

Control program/mechanisms

The control program/strategies in place

Laying hens flocks

According to reg. (IS) no. 904/2001 and in accordance with surveillance strategies implemented by the former Chief Veterinary Office, flocks are sampled at rearing by taking fecal samples at 2 - 4 weeks of age and again at 12 - 15 weeks of age. During production, fecal samples are taken at 25 - 30 weeks of age and at 55 - 60 weeks of age. If the flock is intended for slaughter fecal samples are taken 14 days prior to slaughter.

According to reg. (IS) no. 688/2002 and in accordance with surveillance strategies implemented by the former Chief Veterinary Office, official samples are taken from each slaughter batch by through one pooled sample consisting of 50 neck skins.

A national control programme was published by the Competent Authority on 1.11.2008 for the control of salmonella in poultry. The control programme was developed according to reg. (EC) no. 1003/2005. It includes sampling at rearing (2 weeks before moving to the laying house) and sampling every 15 weeks during production.

The industry bears the cost of the sampling directly for samples taken at the farm, and then indirectly for samples taken at the time of slaughter through a fee taken per kg of slaughtered meat.

According to Icelandic legal act no. 25/1993 it is prohibited to import poultry to Iceland. Exception can however be given when quarantine is possible. No live laying hens and no hatching eggs for laying hens are imported to Iceland.

Measures in case of the positive findings or single cases

Laying hens flocks

According to Icelandic legal act no. 25/1993 and reg. (IS) no. 665/2001 birds from a salmonella positive flock may not be moved from the farm and it is forbidden to distribute eggs from a salmonella infected flock. According to reg. (IS) no. 688/2002 it is also forbidden to send a salmonella positive flock to the slaughterhouse. Therefore a positive flock will be culled at the farm.

Notification system in place

Salmonella is a notifiable disease according to Icelandic legal act no. 25/1993. The laboratory sends an immediate notification to the CA when there is a positive salmonella finding.

Results of the investigation

Salmonella was dected only once in laying hence in 2011 from a fecal samples taken by an FBO from a backyard flock. Official samples taken for confirmation were however all negative.

National evaluation of the recent situation, the trends and sources of infection

After the implementation of the national control programme in 2008, salmonella has only been detected twice, once in an official dust sample on a commercial laying hen farm in 2010 and once in fecal samples taken by an FBO in a backyard flock in 2011. Official samples taken for confirmation were however in both cases all negative. Salmonella had never been detected in flocks of laying hens before 2008. The source of the infection in both cases remains unclear. There is however a certain lack of compliance with the sampling scheme and therefore it is difficult to evaluate the trend of salmonella in laying hens.

Salmonella has been found only twice in laying hens since reg. (IS) no. 904/2001 was implemented and

there has never been any evidence that eggs from these flocks caused any human infections.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

There is no indication that salmonella in Icelandic table eggs or egg products is a major source of infections in humans. Salmonella Enteritidis has never been found in laying hens and is not frequently found in humans. Table eggs have never been suspected as the source of foodborne outbreaks in humans after 2002.

D. Salmonella spp. in ducks - breeding flocks and meat production flocks

Monitoring system

Sampling strategy

Breeding flocks

The monitoring of salmonella in duck breeding flocks is applied to the whole country.

Every breeding flock comprising 250 animals or more is sampled. At primary production samples are both taken by the Food Buisness Operator (FBO) and by the Competent Authority (CA) in accordance with the national control programme.

According to import regulations breeder flocks are also under surveillance at the time of rearing during quarantine.

At the time of rearing samples are taken at the farm, and during production samples are taken at the hatchery. If a breeder flock is slaughtered, official samples are taken from each slaughter batch at the time of slaughter, after evisceration but before chilling.

The sampling strategy is according to national requirements that were implemented in 2001 and 2002 and a national control programme that was first implemented in 2008, in accordance with reg. (EC) no. 1003/2005

In Iceland, there are only parent flocks.

Meat production flocks

The monitoring of salmonella is in accordance with a national control programme that was implemented in 2008 and applies to the country as a whole.

Each flock is sampled at the farm less than 3 weeks prior to slaughter. Samples are taken by the FBO. Official samples are also taken from each slaughter batch at the time of slaughter, after evisceration but before chilling.

Frequency of the sampling

Breeding flocks: Day-old chicks

Every flock is sampled

Breeding flocks: Rearing period

At the age of 4 weeks and again 2 weeks before moving to the laying house.

Breeding flocks: Production period

Every 2 weeks.

Meat production flocks: Before slaughter at farm

3 weeks prior to slaughter.

Meat production flocks: At slaughter (flock based approach)

Every flock is sampled

Type of specimen taken

Breeding flocks: Day-old chicks

Hatched eggs

Breeding flocks: Rearing period

Socks/ boot swabs

Breeding flocks: Production period

Socks/ boot swabs

Meat production flocks: Before slaughter at farm

Faeces

Meat production flocks: At slaughter (flock based approach)

Neck skin

Methods of sampling (description of sampling techniques)

Breeding flocks: Day-old chicks

From each breeding flock (paternal line and maternal line separately) one sample is taken during hatching. The pooled sample consists of 10 g of broken eggshells taken from a total of 25 separate hatcher baskets, which is in total at least 250 g of broken eggshells.

Breeding flocks: Rearing period

From each breeding flock two pairs of boot swabs are collected and pooled into one pooled sample, both at the age of 4 weeks and two weeks before moving to the laying phase.

Breeding flocks: Production period

From each breeding flock one sample is taken at the hatchery. The pooled sample is consists of 10 g of broken eggshells taken from a total of 25 separate hatcher baskets, which is in total of at least 250g of broken eggshells. If eggs from a flock are incubated less then on a fortnight basis, a sample is taken each time during hatching.

Meat production flocks: Before slaughter at farm

From each broiler flock, one pooled sample consisting of two pairs of boot swabs or one pooled sample consisting of 60 fecal samples are taken.

Meat production flocks: At slaughter (flock based approach)

From each flock, one pooled sample consisting of 50 neck skin samples is taken with each neck skin sample weighting between 3-5 g. These samples are collected from several slaughter batches.

Case definition

Breeding flocks: Day-old chicks

A sample positive for Salmonella spp.

Breeding flocks: Rearing period

A sample positive for Salmonella spp.

Breeding flocks: Production period

A sample is considered positive for Salmonella spp., if it is found in an official sample or, if a positive sample taken by the FBO is confirmed through official sampling at the farm.

Meat production flocks: Before slaughter at farm

A sample positive for Salmonella spp. According to the national control programne confirmation samples are only taken as a part of FBO´s own controls. If salmonella is not found in two subsequent samples taken from the same flock as the positive sample, given that the latest sample was taken by an official

veterinarian, the flock is considered to be negative.

Meat production flocks: At slaughter (flock based approach)

A sample positive for Salmonella spp.

Diagnostic/analytical methods used

Breeding flocks: Day-old chicks

Bacteriological method: NMKL No 71:1999

Breeding flocks: Rearing period

Bacteriological method: NMKL No 71:1999

Breeding flocks: Production period

Bacteriological method: NMKL No 71:1999

Meat production flocks: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Meat production flocks: At slaughter (flock based approach)

Bacteriological method: NMKL No 71:1999

Vaccination policy

Breeding flocks

Vaccination of poultry flocks against salmonella is not practiced and there is no intention that it will become a part of control strategies.

Meat production flocks

Vaccination of poultry flocks against salmonella is not practiced and there is no intention that it will become a part of control strategies.

Other preventive measures than vaccination in place

Breeding flocks

Preventative measures include specific requirements regarding biosecurity in accordance with national legislation.
Preventative treatment with antibiotics is not practiced in Iceland, and although the treatment is not specifically prohibited it is however against Icelandic policy regarding the use of antimicrobials.

Meat production flocks

Preventative measures include specific requirements regarding biosecurity in accordance with national legislation.
Preventative treatment with antibiotics is not practiced in Iceland, and although the treatment is not specifically prohibited it is however against Icelandic policy regarding the use of antimicrobials.

Control program/mechanisms

The control program/strategies in place

Breeding flocks

A national control programme was published by the Competent Authority on 1.11.2008 for the control of salmonella in poultry. The control programme was developed according to reg. (EC) no. 1003/2005. It includes sampling at rearing (day old chicks, at 4 weeks of age and 2 weeks before moving to the laying

house) and sampling every other week during production at the hatchery.

According to reg. (IS) no. 688/2002 and according to surveillance strategies implemented by the former Chief Veterinary Office official samples are taken from each slaughter batch by taking one pooled sample consisting of 50 neck skins.

The industry bears the cost of the sampling directly for samples taken at the farm, and indirectly for samples taken at the time of slaughter through a fee taken per kg of slaughtered meat.

According to Icelandic legal act no. 25/1993 it is prohibited to import poultry to Iceland. Exceptions can however be given for hatching eggs or day old chicks for parents, if they are submitted to quarantine upon entry. A negative result for Salmonella spp. from grandparent flock is a necessary requirement before permission is given for a shipment of hatching eggs or day old chicks to be imported to Iceland.

Meat production flocks

A national control programme was published by the Competent Authority on 1.11.2008 for the control of salmonella in poultry. The control programme was developed according to reg. (EC) no. 646/2007. It describes sampling of each broiler flock at the farm three weeks prior to slaughter.

According to reg.(IS) no. 688/2002 and according to the surveillance strategies implemented by the former Chief Veterinary Office, official samples are taken from each slaughter batch through one pooled sample consisting of 50 neck skins.

The industry bears the cost of sampling directly for samples taken at the farm and indirectly for samples taken at the time of slaughter through a fee taken per kg of slaughtered poultry.

According to Icelandic legal act no. 25/1993 it is prohibited to import poultry to Iceland. Exceptions can however be given for hatching eggs or day old chicks for parents, if they are submitted to quarantine upon entry. Currently no live ducks nor hatching eggs for ducks are imported to Iceland.

Measures in case of the positive findings or single cases

At the farm:
According to Icelandic legal act no. 25/1993 and reg. (IS) no. 665/2001 birds from a salmonella positive flock may not be moved from the farm and it is forbidden to distribute eggs from a salmonella infected flock. According to reg. (IS) no. 688/2002 it is also forbidden to send a salmonella positive flock to the slaughterhouse. Therefore a positive flock will be culled at the farm. It is forbidden to hatch eggs from a positive parent flock.

At the time of slaughter:
According to reg. (IS) no. 688/2002 all meat from a slaughter flock with a positive neck skin sample has to be destroyed or heat treated before further distribution. All raw meat from the flock that is already distributed is also withdrawn and recalled from the market.

Notification system in place

Salmonella is a notifiable disease according to Icelandic legal act no. 25/1993.
The laboratory sends an immediate notification to the CA when there is a positive salmonella finding.

Results of the investigation

In 2011 salmonella was found in one pooled sample of neck skins from one flock.
The source of the contamination remains unclear as Salmonella could not be found on the farm where the respective duck flock was reared, nor in any other flocks on the same farm.

National evaluation of the recent situation, the trends and sources of infection

Since 1997 salmonella prevalence in flocks of ducks both from samples taken at the farm level and at the time of slaughter has been below 1%. In 2011 salmonella was found in one flock but the source of the contamination could not be established.

As flocks have been sampled both at the farm and at the time of slaughter since 2001, no new information has been gained regarding the prevalance of salmonella with the implementation of the new sampling strategy in 2008.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

In Iceland it is forbidden to slaughter salmonella positive poultry flocks. Therefore, the main sources of contaminated poultry meat are flocks with a negative pre-slaughter sample but a positive sample at the time of slaughter. In recent years there have been no indications of human infections stemming from infected icelandic duck meat.

E. Salmonella spp. in pigs

Monitoring system

Sampling strategy

Breeding herds

There are neither breeding herds nor multiplying herds as such in Iceland which produce purebred pigs (f.exs. Landrace , Yorkshire) or hybrid pigs (f.exs. LY, HD) for sale. Breeding or improvement of the stock is done by import of frozen semen from Norway. Therefore all pig herds produce their own purebreds (sows and boars) and hybrid pigs (sows and boars) mostly by insemination.

All pig holdings produce pigs for slaughtering, but some holdings can have separate herds with purebred/hybrid production, sow herds with piglet production or herds with fattening pigs.

All sow herds with piglet production and all herds with purebred/hybrid production shall be faecal sampled once pr. year.

The official sampling is a part of a permanent surveillance programme and performed by the CA (MAST).

Multiplying herds

See breeding herds.

Fattening herds

See also breeding herds.

Surveillance of all slaughter pig herds is carried out at the slaughterhouses by continuous serologic testing of meat juice from all herds. The sampling is objective and random meat samples are collected from carcasses after cooling. Number of samples and frequency of sampling depend on herd size.

Sixty, seventy five or one hundred samples shall be taken from herds slaughtering for less than 2000 pigs pr. year, 2001 – 5000 pigs pr. year and over 5001 pigs pr. year respectively.

A Salmonella index is calculated for each herd based on the weighted average of positive meat juice samples from the previous thirteen weeks, where results from the current period (last five weeks) weigh three times as much as the two previous ones (2 periods each consisting of 4 weeks).

Once or twice a month finisher herds are classified into levels; level one, two or three, according to their Salmonella index. Herds having indexes lower than 39 are categorised into level one, into level two having indexes between 40 and 69 and into level three having indexes higher than 70.

The surveillance programme for detection of Salmonella infection in pig herds was implemented 1st of October 2006.

All herds shall be faecal sampled once pr. year and more often if needed. The official sampling is a part of the surveillance programme and is performed by the CA (MAST).

Frequency of the sampling

Breeding herds

Once a year

Fattening herds at farm

Other: Once a year and when needed

Fattening herds at slaughterhouse (herd based approach)

Other: Depends on herd size

Type of specimen taken

Breeding herds

Faeces

Fattening herds at farm

Faeces

Fattening herds at slaughterhouse (herd based approach)

Meat juice

Methods of sampling (description of sampling techniques)

Breeding herds

The number of faecal samples depends on the herd size. Herds with > 400 animals collect 20 samples and herds with 100 – 400 animals collect 4 – 16 samples.

Fattening herds at farm

The number of faecal samples depends on the herd size. Herds with > 400 animals collect 20 samples and herds with 100 – 400 animals collect 4 – 16 samples.

Fattening herds at slaughterhouse (herd based approach)

Meat samples are collected from carcasses after cooling. The meat samples are collected in special meat juice containers. Number of samples and frequency of sampling depend on herd size.

Case definition

Breeding herds

A herd is considered positive when Salmonella has been isolated from feacal samples.

Fattening herds at farm

A herd is considered positive when Salmonella has been isolated from feacal samples.

Fattening herds at slaughterhouse (herd based approach)

An individual sample is considered seropositive if OD% > 10

Diagnostic/analytical methods used

Breeding herds

Bacteriological method: NMKL No 71:1999

Fattening herds at farm

Bacteriological method: NMKL No 71:1999

Fattening herds at slaughterhouse (herd based approach)

Serological method: SALMOTYPE Pig Screen LDL ELISA

Vaccination policy

Breeding herds

No salmonella vaccination occur

Fattening herds

No salmonella vaccination occur

Other preventive measures than vaccination in place

Breeding herds

In national regulation regarding pigs there are provisions on bio security demanding special facilities for entering the herd, isolation of and delivering pigs.

Multiplying herds

See breeding pigs.

Fattening herds

See breeding pigs.

Separate transport of pigs to slaughterhouse and separate slaughtering of pigs in level three herds.
In national regulation regarding pigs there are provisions on bio security demanding special facilities for entering the herd, isolation of and delivering pigs.

Control program/mechanisms

The control program/strategies in place

Fattening herds

The surveillance programme is constructed to monitor salmonella infections at farm level by measuring antibodies against Salmonella in meat juice test, to survey salmonella contamination on pig carcasses at slaughtering and to monitor Salmonella serotypes in faecal and swab samples. Salmonella serotypes are also tested for antimicrobial resistance.

The mandatory national control programme for Salmonella in pigs is approved by the Competent Authority, MAST. The aim of the programme is to prevent salmonella in pork and thereby mitigate the risk of human salmonellosis.

In order to control Salmonella infections at farm, the national regulation on pig health and housing No. 353/2011 stipulates preventive measures to be implemented.

Recent actions taken to control the zoonoses

The ongoing national control programme for Salmonella in pigs was implemented 1st of October 2006. Because of the nature of the pig production in Iceland especially the feeding system where pig producers bought unheated raw materials from feed mills for feed production the pig production as a whole was considered as a risk for human salmonellosis. When an increase in positive meat juice samples were clearly noted in the years 2009 and 2010 the then national regulation for pig health and housing was amended and entered into force 6th of April 2011 in order to control Salmonella infections at farm level.

Measures in case of the positive findings or single cases

Measures are taken (described in Salmonella spp in pig meat and products therof) when herds are moved between levels or categories i.e. when a herd is downgraded from level 1 to level 2 or 3. Sanitary slaughtering is performed when herds are categorised as level 3 herds.

Level 2 and 3 herds are obliged to be faecal sampled within fifteen days after being scaled down from the above level.

Notification system in place

Salmonella is a notifiable disease, according to national legislation on animal diseases No. 25/1993. The Competent Authority, MAST, receives all results from the respective laboratories regarding Salmonella testing (including serotyping and antimicrobial resistance) on samples from pig production and slaughtering.

Results of the investigation

Salmonella is endemic in the pig production. Salmonella was found in 37,5% of the pig herds. Of all meat juice samples 15,1% were positive for Salmonella. At farm Salmonella Worthington, Salmonella Infantis, Salmonella Kedougou and Salmonella Typhimurium were found.

National evaluation of the recent situation, the trends and sources of infection

Meat juice samples have been taken since 2004 even though this test method was first used as an official method for Salmonella monitoring after 1st of October 2006. A fluctuation was seen in positive meat juice samples from the year 2004 to the year 2008 but within the limits of 1 - 5%.

In the next consecutive years i.e. in 2009 and 2010 the prevalence ascended significantly (12,7% and 23,4%). In 2011 the prevalence descended again to 17,2%.

Despite of the increase in Salmonella in the pig production salmonellosis in humans in the same period did not alter equally. On the contrary domestic cases of salmonellosis in humans were fewer in 2009 and 2010 compared to domestic cases in the previous years.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

Salmonella in pig production seems not to be a major source for human infections.

F. Salmonella spp. in turkey - breeding flocks and meat production flocks

Monitoring system

Sampling strategy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

The monitoring of salmonella in turkey breeding flocks covers the whole country.

Every breeding flock consisting of 250 animals or more is sampled. During primary production samples are both taken by the food buisness operator (FBO) and by the competent authority (CA) in accordance with the national control programme.

According to import regulations, breeder flocks are also under surveillance at the time of rearing while they are in quarantine. At the time of rearing samples are taken at the farm, and during production samples are taken at the hatchery. When a breeder flock is slaughtered official samples are taken from each slaughter batch during slaughter, after evisceration but before chilling.

The sampling strategy is according to national requirements that were implemented in 2001 and 2002 and a national control programme that was first implemented in 2008 in accordance with reg. (EC) no. 1003/2005.

In Iceland, there are only parent flocks.

Meat production flocks

The sampling strategy is according to a control programme that was implemented in 2008 and applies to the whole of Iceland.

Every flock is sampled at the farm less than 3 weeks prior to slaughter. Samples are taken by the FBO. Official samples are also taken from each slaughter batch at the time of slaughter, after evisceration but before chilling.

Frequency of the sampling

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Every flock is sampled

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

At the age of 4 weeks and again two weeks before moving to the laying house.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Every 2 weeks.

Meat production flocks: Before slaughter at farm

3 weeks prior to slaughter.

Meat production flocks: At slaughter (flock based approach)

Every batch is sampled ____

Type of specimen taken

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Hatched eggs

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Socks/ boot swabs

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Hatched eggs

Meat production flocks: Before slaughter at farm

Faeces

Meat production flocks: At slaughter (flock based approach)

Neck skin

Methods of sampling (description of sampling techniques)

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

From each breeding flock (paternal line and maternal line separately) one sample is taken during hatching. The pooled sample consists of 10 g of broken eggshells taken from a total of 25 separate hatcher baskets, which in total is at least 250g of broken eggshells.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

From each breeding flock two pairs of boot swabs are collected and pooled into one sample, both at the age of 4 weeks and two weeks before moving to the laying phase.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

From each breeding flock one sample is taken at the hatchery. The pooled sample consists of 10 g of broken eggshells taken from a total of 25 separate hatcher baskets, which in total is at least 250g of broken eggshells. If eggs from a flock are incubated less then on a fortnight basis, a sample is taken each time during hatching.

Meat production flocks: Before slaughter at farm

From each broiler flock two pairs of boot swabs are collected and pooled into one sample or one pooled sample consisting of 60 fecal samples is taken.

Meat production flocks: At slaughter (flock based approach)

From each slaughter flock, one pooled sample consisting of 50 neck skin samples is taken with each neck skin sample weighting between 3 - 5 g.

Case definition

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

A sample positive for Salmonella spp.

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

A sample is considered positive for Salmonella spp. if is found in an official sample or if a positive sample taken by the FBO is confirmed with official sampling at the farm.

Meat production flocks: Before slaughter at farm

A flock is considered positive when Salmonella spp. is found in a sample.

According to the national control programme, no confirming samples are taken except as a part of FBO’s own controls. When salmonella is not found in two subsequent samples taken from the same flock as the positive sample, given that the latest sample was taken by an official veterinarian, the flock is considered to be negative.

Meat production flocks: At slaughter (flock based approach)

A sample positive for Salmonella spp.

Diagnostic/analytical methods used

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Day-old chicks

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Rearing period

Bacteriological method: NMKL No 71:1999

Breeding flocks (separate elite, grand parent and parent flocks when necessary): Production period

Bacteriological method: NMKL No 71:1999

Meat production flocks: Before slaughter at farm

Bacteriological method: NMKL No 71:1999

Meat production flocks: At slaughter (flock based approach)

Bacteriological method: NMKL No 71:1999

Vaccination policy

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Vaccination of poultry flocks against salmonella is not practiced and there is no intention for it to become a part of control strategies.

Meat production flocks

Vaccination of poultry flocks against salmonella is not practiced and there is no intention for it to become a part of control strategies.

Other preventive measures than vaccination in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

Preventative measures include specific requirements regarding biosecurity in accordance with national legislation.
Preventative treatment with antibiotics is not practiced in Iceland, and although the treatment is not specifically prohibited it is however against Icelandic policy regarding the use of antimicrobials

Meat production flocks

Preventative measures include specific requirements regarding biosecurity in accordance with national legislation.
Preventative treatment with antibiotics is not practiced in Iceland, and although the treatment is not specifically prohibited it is however against Icelandic policy regarding the use of antimicrobials

Control program/mechanisms

The control program/strategies in place

Breeding flocks (separate elite, grand parent and parent flocks when necessary)

A national control programme was published by the Competent Authority on 1.11.2008 for the control of salmonella in poultry. The control programme was developed according to reg. (EC) no. 1003/2005 and (EC) no. 584/2008.

It includes sampling at rearing (day old chicks, at 4 weeks of age and 2 weeks before moving to the laying house) and sampling every other week during production at the hatcher

ccording to reg. (IS) no. 688/2002 and the surveillance strategies implemented by the former Chief Veterinary Office, official samples are taken from each slaughter batch by taking one pooled sample of 50 neck skins.

The industry bears the cost of the sampling directly for samples taken at the farm, and indirectly for samples taken at the time of slaughter through a fee taken per kg of slaughtered meat.

According to Icelandic legal act no. 25/1993 it is prohibited to import poultry to Iceland. Exceptions can however be given for hatching eggs or day old chicks for parents, if they are submitted to quarantine upon entry. A negative result for Salmonella spp. from grandparent flock is a necessary requirement before permission is given for a shipment of hatching eggs or day old chicks to be imported to Iceland.

Meat production flocks

A national control programme was published by the Competent Authority on 1.11.2008 for the control of salmonella in poultry. The control programme was developed according to reg. (EC) nr. 584/2008. It describes sampling of each broiler flock at the farm three weeks prior to slaughter.

According to reg.(IS) no. 688/2002 and according to the surveillance strategies implemented by the former Chief Veterinary Office, official samples are taken from each slaughter batch through one pooled sample consisting of 50 neck skins.

The industry bears the cost of sampling directly for samples taken at the farm and indirectly for samples taken at the time of slaughter through a fee taken per kg of slaughtered poultry.

According to Icelandic legal act no. 25/1993 it is prohibited to import poultry to Iceland. Exceptions can however be given for hatching eggs or day old chicks for parents, if they are submitted to quarantine upon entry. Currently no live turkeys nor hatching eggs for turkeys for meat production are imported to Iceland.

Measures in case of the positive findings or single cases

Before moving to the slaughterhouse:
According Icelandic legal act no. 25/1993 and reg. (IS) no. 665/2001 birds from a flock that has been tested positive may not be moved from the farm. According to reg. (IS) no. 688/2002 a positive flock cannot be sent to the slaughterhouse and must be culled at the farm. It is not allowed to hatch eggs from a positive parent flock.

At the time of slaughter:
According to reg. (IS) no. 688/2002 all meat from a slaughter flock with a positive neck skin sample has to be destroyed or heat treated before further distribution. All raw meat from the flock that is already distributed is also withdrawn and recalled from the market.

Notification system in place

Salmonella is a notifiable disease according to Icelandic legal act no. 25/1993.
The laboratory sends an immediate notification to the CA when there is a positive salmonella finding.

Results of the investigation

No cases of Salmonella spp. have been found in flocks of turkey.

National evaluation of the recent situation, the trends and sources of infection

Prevalence of salmonella in turkey flocks has been below 1% or not more than one infected flock per year in the last years. Since 1997 salmonella prevalence in flocks of turkey, both from samples taken at the farm level and at the time of slaughter, there has been at the most one infected flock per year. In 2009 and 2010 there was one infected flock detected each year. In 2011 there was no salmonella found in turkey flocks.

For both cases of salmonella in 2009 and 2010 the source of contamination is believed to be contaminated feedstuff.

As flocks have been sampled both at the farm and at the time of slaughter since 2001 there has been no new information received through implementation of the new sampling strategy in 2008.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

In Iceland it is forbidden to slaughter salmonella positive poultry flocks. Therefore, the main sources of contaminated poultry meat are flocks with a negative pre-slaughter sample but a positive sample at the time of slaughter. In recent years there have been no indications of any human infections stemming from infected Icelandic turkey meat.

Table Salmonella in breeding flocks of Gallus gallus

	No of flocks under control programme	Source of information	Sampling strategy	Sampler	Sample type	Sample Origin	Target Verification	Sampling unit	Units tested	Total units positive for Salmonella	S. Enteritidis
Gallus gallus (fowl) - parent breeding flocks for egg production line - day-old chicks - Control and eradication programmes	1	Keldur	Census	Industry sampling	animal sample > eggshells		no	Flock	1	0	
Gallus gallus (fowl) - parent breeding flocks for egg production line - during rearing period - Control and eradication programmes	2	Keldur	Census	Industry sampling	environmental sample > boot swabs		no	Flock	1	0	
Gallus gallus (fowl) - parent breeding flocks for egg production line - adult - Control and eradication programmes	11	Keldur	Census	Official and industry sampling	animal sample > eggshells		no	Flock	8	0	
Gallus gallus (fowl) - parent breeding flocks for broiler production line - day-old chicks - Control and eradication programmes	8	Keldur	Census	Industry sampling	animal sample > eggshells		no	Flock	8	0	
Gallus gallus (fowl) - parent breeding flocks for broiler production line - during rearing period - Control and eradication programmes	13	Keldur	Census	Industry sampling	environmental sample > boot swabs		no	Flock	13	0	
Gallus gallus (fowl) - parent breeding flocks for broiler production line - adult - Control and eradication programmes	24	Keldur	Census	Official and industry sampling	animal sample > eggshells		no	Flock	24	0	
Gallus gallus (fowl) - breeding flocks for broiler production line - adult - at farm - Control and eradication programmes	10	Keldur	Census	Official and industry sampling	environmental sample > boot swabs		no		10	0	

Table Salmonella in breeding flocks of Gallus gallus

	S. Hadar	S. Infantis	S. Typhimurium	S. Virchow	S. 1,4,[5],12:i:-	Salmonella spp., unspecified
Gallus gallus (fowl) - parent breeding flocks for egg production line - day-old chicks - Control and eradication programmes						
Gallus gallus (fowl) - parent breeding flocks for egg production line - during rearing period - Control and eradication programmes						
Gallus gallus (fowl) - parent breeding flocks for egg production line - adult - Control and eradication programmes						
Gallus gallus (fowl) - parent breeding flocks for broiler production line - day-old chicks - Control and eradication programmes						
Gallus gallus (fowl) - parent breeding flocks for broiler production line - during rearing period - Control and eradication programmes						
Gallus gallus (fowl) - parent breeding flocks for broiler production line - adult - Control and eradication programmes						
Gallus gallus (fowl) - breeding flocks for broiler production line - adult - at farm - Control and eradication programmes						

Footnote:

From a total of 34 adult breeding flocks for broiler production line, a total of 34 breeding flocks have been tested, either by taking eggshell samples or by taking bootswab samples or by taking both. Figures are given in such a way that it is possible to summarize the two rows for adult breeding flocks for broiler production, but actually more flocks have been sampled by taking bootswab samples.

Table Salmonella in other animals

	Source of information	Sampling strategy	Sampler	Sample type	Sample Origin	Sampling unit	Units tested	Total units positive for Salmonella	S. Enteritidis	S. Typhimurium	S. 1,4,[5],12:i:-
Pigs - breeding animals - at farm - Monitoring	MAST	Selective sampling	Official sampling	animal sample > faeces		Herd	4	2			
Pigs - fattening pigs - at farm - Monitoring	MAST	Selective sampling	Official sampling	animal sample > faeces		Herd	12	4			
Pigs - fattening pigs - at slaughterhouse - Monitoring	MAST	Objective sampling	Official sampling	animal sample > meat juice		Animal	1437	243			

	Salmonella spp., unspecified	S. Infantis	S. Kedougou	S. Typhimurium, monophasic - DT 120	S. Worthington
Pigs - breeding animals - at farm - Monitoring		1	1	1	
Pigs - fattening pigs - at farm - Monitoring		1		1	2
Pigs - fattening pigs - at slaughterhouse - Monitoring	243				

Footnote:

Two herds (breeding animals) are positive for Salmonella but in one herd two serotypes were detected.

Table Salmonella in other poultry

	No of flocks under control programme	Source of information	Sampling strategy	Sampler	Sample type	Sample Origin	Target Verification	Sampling unit	Units tested	Total units positive for Salmonella	S. Enteritidis
Gallus gallus (fowl) - laying hens - day-old chicks - Control and eradication programmes [1)]	64										
Gallus gallus (fowl) - laying hens - during rearing period - Control and eradication programmes	43	Keldur	Census	Official and industry sampling	animal sample > faeces		no	Flock	1	0	
Gallus gallus (fowl) - laying hens - adult - at farm - Control and eradication programmes [2)]	43	Keldur	Census	Official and industry sampling	animal sample > faeces		no	Flock	22	0	
Gallus gallus (fowl) - broilers - before slaughter - at farm - Control and eradication programmes [3)]	637	Keldur, Matís	Census	Official and industry sampling	environmental sample > boot swabs		no	Flock	637	14	
Turkeys - breeding flocks, unspecified - day-old chicks - at farm - Control and eradication programmes	2	Keldur	Census	Official sampling	animal sample > eggshells		no	Flock	2	0	
Turkeys - breeding flocks, unspecified - during rearing period - at farm - Control and eradication programmes [4)]	2	Keldur	Census	Industry sampling	animal sample > faeces		no	Flock	2	0	
Turkeys - breeding flocks, unspecified - adult - at farm - Control and eradication programmes	3	Keldur	Census	Official and industry sampling	animal sample > eggshells		no	Flock	3	0	
Turkeys - fattening flocks - before slaughter - at farm - Control and eradication programmes	22	Keldur	Census	Official and industry sampling	animal sample > faeces		no	Flock	22	0	
Ducks - meat production flocks	26	Keldur	Census	Industry sampling	animal sample > faeces		no	Flock	26	0	
Turkeys - breeding flocks, unspecified - adult - at farm - Control and eradication programmes (one sample consisted of 60 fecal samples instead of 5 pairs of bootswabs.)	3	Keldur	Census	Official and industry sampling	environmental sample > boot swabs		no	Flock	3	0	

Table Salmonella in other poultry

	S. Typhimurium	S. 1,4,[5],12:i:-	Salmonella spp., unspecified	S. Agona	S. Infantis
Gallus gallus (fowl) - laying hens - day-old chicks - Control and eradication programmes [1)]					
Gallus gallus (fowl) - laying hens - during rearing period - Control and eradication programmes					
Gallus gallus (fowl) - laying hens - adult - at farm - Control and eradication programmes [2)]					
Gallus gallus (fowl) - broilers - before slaughter - at farm - Control and eradication programmes [3)]				13	1
Turkeys - breeding flocks, unspecified - day-old chicks - at farm - Control and eradication programmes					
Turkeys - breeding flocks, unspecified - during rearing period - at farm - Control and eradication programmes [4)]					
Turkeys - breeding flocks, unspecified - adult - at farm - Control and eradication programmes					
Turkeys - fattening flocks - before slaughter - at farm - Control and eradication programmes					
Ducks - meat production flocks					
Turkeys - breeding flocks, unspecified - adult - at farm - Control and eradication programmes (one sample consisted of 60 fecal samples instead of 5 pairs of bootswabs.)					

Comments:

[1)] Samples taken at hatchery from parent flocks considered also as samples from day-old-chicks. To prevent double reporting, no figures are given up for

Table Salmonella in other poultry

Comments:

day-old-chicks.

[2)] Official samples consist of one fecal sample and one dust sample

[3)] In some cases, fecal samples were taken instead of bootswabs

[4)] Also environmental samples taken (bootswabs)

2.1.4 Salmonella serovars and phagetype distribution

The methods of collecting, isolating and testing of the Salmonella isolates are described in the chapters above respectively for each animal species, foodstuffs and humans. The serotype and phagetype distributions can be used to investigate the sources of the Salmonella infections in humans. Findings of same serovars and phagetypes in human cases and in foodstuffs or animals may indicate that the food category or animal species in question serves as a source of human infections. However as information is not available from all potential sources of infections, conclusions have to be drawn with caution.

Table Salmonella serovars in animals

Serovar	Cattle (bovine animals)				Pigs				Gallus gallus (fowl)				Other poultry
Sources of isolates	Control program	Monitoring	Clinical	Surveillance	Control program	Monitoring	Clinical	Surveillance	Control program	Monitoring	Clinical	Surveillance	Control program
Number of isolates in the laboratory						25			14	12			
Number of isolates serotyped	0	0	0	0	0	10	0	0	14	0	0	0	0
Number of isolates per serovar													
S. Typhimurium, monophasic - DT 120						3							
S. Agona									13				
S. Infantis						2			1				
S. Kedougou						1							
S. Worthington						4							

Table Salmonella serovars in animals

Serovar	Other poultry		
Sources of isolates	Monitoring	Clinical	Surveillance
Number of isolates in the laboratory			
Number of isolates serotyped	0	0	0
Number of isolates per serovar			
S. Typhimurium, monophasic - DT 120			
S. Agona			
S. Infantis			
S. Kedougou			
S. Worthington			

Table Salmonella serovars in food

Serovar	Meat from bovine animals		Meat from pig		Meat from broilers (Gallus gallus)		Meat from other poultry species		Other products of animal origin	
Sources of isolates	Monitoring	Surveillance	Monitoring	Surveillance	Monitoring	Surveillance	Monitoring	Surveillance	Monitoring	Surveillance
Number of isolates in the laboratory				4		8		1		
Number of isolates serotyped	0	0	0	4	0	8	0	1	0	0
Number of isolates per serovar										
S. Enteritidis				1						
S. Infantis						8				
S. Montevideo								1		
S. Sandiego				2						
S. Worthington				1						

2.1.5 Antimicrobial resistance in Salmonella isolates

A. Antimicrobial resistance in Salmonella in foodstuff derived from pigs

Sampling strategy used in monitoring

Frequency of the sampling

Salmonella found on pig carcasses in the Icelandic Salmonella Control Programme is included in the resistance monitoring. All herds are always objective sampled but in a case of a positive sample the herd is census sampled. At least one serotype is tested for antimicrobial sensitivity.

Type of specimen taken

The carcasses are swabbed with cotton swabs. Isolates from positve swabs are tested.

Methods of sampling (description of sampling techniques)

See Salmonella spp. in pig meat and products thereof.

Procedures for the selection of isolates for antimicrobial testing

Salmonella is isolated at various laboratories and sent to the National Hospital in Reykjavík for testing of antimicrobial susceptibility.

Methods used for collecting data

The laboratories send regularly data to MAST or as soon as results are obtained.

Laboratory methodology used for identification of the microbial isolates

The Salmonella Tecra Unique Rapid Test is used for detection of Salmonella (Enrichment immunocapture immunoenrichment and detection steps). When Salmonella is detected in the Tecra test, the Bacteriological method used is: NMKL 187:2007

Laboratory used for detection for resistance

Antimicrobials included in monitoring

Ampicillin, Ceftriaxone, Chloramphenicol, TMP/Sulfa, Nalidixic acid, Ciprofloxacin.

Cut-off values used in testing

The values used are clinical cut-off values.
Ampicillin: R <= 13
Ceftriaxone: R <=19
Chloramphenicol: R <=12
TMP/Sulfa: R <=10
Nalidixic acid: R <=13
Ciprofloxacin: R <=20

Preventive measures in place

See Salmonella in pigs.

Control program/mechanisms

The control program/strategies in place

See Salmonella spp. in pig meat and products thereof.

Recent actions taken to control the zoonoses

See Salmonella in pigs.

Measures in case of the positive findings or single cases

According to the national control programme no specific actions are taken regarding antimicrobial resistance unless multiresistant Salmonella Typhimurium is detected at farm. If multiresistant Salmonella Typhimurium is found at farm the pigs from the respective herd are sanitary slaughtered.

Notification system in place

See Salmonella spp. in pig meat and products thereof.

Results of the investigation

No resistance was found in the isolates to the tested antimicrobials.

National evaluation of the recent situation, the trends and sources of infection

See Salmonella spp. in pig meat and products thereof.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

See Salmonella spp. in pig meat and products thereof.

B. Antimicrobial resistance in Salmonella in foodstuff derived from poultry

Sampling strategy used in monitoring

Frequency of the sampling

Salmonella found on poultry carcasses in samples taken according to the Icelandic Salmonella Control Programme is included in the resistance monitoring. All positive samples are serotyped and tested for antimicrobial sensitivity.

Type of specimen taken

See Chapter Salmonella spp. in broiler meat and products thereof and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Methods of sampling (description of sampling techniques)

See Chapater Salmonella spp. in broiler meat and products thereof and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Procedures for the selection of isolates for antimicrobial testing

Salmonella is isolated at various laboratories and sent to the laboratory at the National Hospital in Reykjavík for testing of antimicrobial susceptibility.

Methods used for collecting data

The laboratories send regularly data to MAST or as soon as results are obtained.

Laboratory methodology used for identification of the microbial isolates

NMKL No 71:1999

Laboratory used for detection for resistance

Antimicrobials included in monitoring

Ampicillin, Ceftriaxone, Chloramphenicol, TMP/Sulfa, Nalidixic acid, Ciprofloxacin.

Cut-off values used in testing

The values used are clinical cut-off values.
Ampicillin: R <= 13
Ceftriaxone: R <=19
Chloramphenicol: R <=12
TMP/Sulfa: R <=10
Nalidixic acid: R <=13
Ciprofloxacin: R <=20

Preventive measures in place

See Chapater Salmonella spp. in broiler meat and products thereof and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Control program/mechanisms

The control program/strategies in place

See Chapater Salmonella spp. in broiler meat and products thereof and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Recent actions taken to control the zoonoses

See Chapater Salmonella spp. in broiler meat and products thereof and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Measures in case of the positive findings or single cases

According to the Icelandic animal health legislation MAST (CA) can take any measures that are needed if

multiresistant isulates are found.

Notification system in place

See Chapater Salmonella spp. in broiler meat and products thereof and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Results of the investigation

No resistance was found in the isolates to the tested antimicrobials.

National evaluation of the recent situation, the trends and sources of infection

See Chapater Salmonella spp. in broiler meat and products thereof and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

See Chapater Salmonella spp. in broiler meat and products thereof and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

C. Antimicrobial resistance in Salmonella in pigs

Sampling strategy used in monitoring

Frequency of the sampling

Salmonella found in pig herds in the Icelandic Salmonella Monitoring Programme is included in the resistance monitoring (at least one isolate per herd). All herds are to be sampled once pr. year.

Type of specimen taken

Salmonella isolates from faecal samples are susceptibility testet. Isolates from all herds are tested, i.e. breeding herds, piglet production herds and herds with fattening pigs.

Methods of sampling (description of sampling techniques)

For description of the Icelandic Salmonella Control programme, see the parts describing Salmonella in pigs. Other sampling methods vary depending on the situation.

Procedures for the selection of isolates for antimicrobial testing

At least one isolate per herd is selected for antimicrobial testing. Salmonella is isolated at various laboratories and sent to the National Hospital in Reykjavík for testing of antimicrobial susceptibility.

Methods used for collecting data

The laboratories send regularly data to MAST or as soon as results are obtained.

Laboratory methodology used for identification of the microbial isolates

NMKL No 71:1999

Laboratory used for detection for resistance

Antimicrobials included in monitoring

Ampicillin, Ceftriaxone, Chloramphenicol, TMP/Sulfa, Nalidixic acid, Ciprofloxacin.

Cut-off values used in testing

The values used are clinical cut-off values.
Ampicillin: R <= 13
Ceftriaxone: R <=19
Chloramphenicol: R <=12
TMP/Sulfa: R <=10
Nalidixic acid: R <=13
Ciprofloxacin: R <=20

Preventive measures in place

If multiresistant Salmonella Typhimurium is found in a herd the pigs from the herd are sanitary slaughtered.

Control program/mechanisms

The control program/strategies in place

The Salmonella isolates from pigs originate from the Icelandic Salmonella surveillance programme. The results of a serosurveillance at the slaughterhouses appoint risk herds to be further examined by analyzing pen-faecal samples from finisher herds at level 2 and level 3 farms.

Recent actions taken to control the zoonoses

See Salmonella in pigs.

Measures in case of the positive findings or single cases

According to the national control programme no specific actions are taken regarding antimicrobial resistance unless multiresistant Salmonella Typhimurium is detected at farm. If multiresistant Salmonella Typhimurium is found at farm the pigs from the respective herd are sanitary slaughtered.

Notification system in place

See Salmonella in pigs.

Results of the investigation

Resistance to Ampicillin and TMP/Sulfa was found in one isolate that was serotyped as Salmonella Kedougou.

National evaluation of the recent situation, the trends and sources of infection

The isolates investigated are virtually all sensitive to the six tested antimicrobials. Only one isolate was resistant to two antimicrobials. It must be kept in mind that results are interpreted from clinical cut-off values but not from epidemiological cut-off values.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

See Salmonella spp. in pigs.

D. Antimicrobial resistance in Salmonella in poultry

Sampling strategy used in monitoring

Frequency of the sampling

Salmonella found in poultry in samples taken according to the Icelandic Salmonella Control Programme is included in the resistance monitoring. All positive samples are serotyped and tested for antimicrobial sensitivity.

Type of specimen taken

See Chapter Salmoella spp. in Gallus Gallus - breeding flocks, broiler flocks and flocks of leaying hens and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Methods of sampling (description of sampling techniques)

See Chapter Salmoella spp. in Gallus Gallus - breeding flocks, broiler flocks and flocks of leaying hens and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Procedures for the selection of isolates for antimicrobial testing

Salmonella is isolated at various laboratories and sent to the laboratory at the National Hospital in Reykjavík for testing of antimicrobial susceptibility.

Methods used for collecting data

The laboratories send regularly data to MAST or as soon as results are obtained.

Laboratory methodology used for identification of the microbial isolates

NMKL No 71:1999

Laboratory used for detection for resistance

Antimicrobials included in monitoring

Ampicillin, Ceftriaxone, Chloramphenicol, TMP/Sulfa, Nalidixic acid, Ciprofloxacin.

Cut-off values used in testing

The values used are clinical cut-off values.
Ampicillin: R <= 13
Ceftriaxone: R <=19
Chloramphenicol: R <=12
TMP/Sulfa: R <=10
Nalidixic acid: R <=13
Ciprofloxacin: R <=20

Preventive measures in place

See Chapter Salmoella spp. in Gallus Gallus - breeding flocks, broiler flocks and flocks of leaying hens and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Control program/mechanisms

The control program/strategies in place

See Chapter Salmoella spp. in Gallus Gallus - breeding flocks, broiler flocks and flocks of leaying hens and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Recent actions taken to control the zoonoses

See Chapter Salmoella spp. in Gallus Gallus - breeding flocks, broiler flocks and flocks of leaying hens and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Measures in case of the positive findings or single cases

According to the Icelandic animal health legislation MAST (CA) can take any measures that are needed if

multiresistant isulates are found.

Notification system in place

See Chapter Salmoella spp. in Gallus Gallus - breeding flocks, broiler flocks and flocks of leaying hens and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Results of the investigation

No resistance was found in the isolates to the tested antimicrobials.

National evaluation of the recent situation, the trends and sources of infection

See Chapter Salmoella spp. in Gallus Gallus - breeding flocks, broiler flocks and flocks of leaying hens and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

See Chapter Salmoella spp. in Gallus Gallus - breeding flocks, broiler flocks and flocks of leaying hens and Chapter Salmonella spp. in ducks and turkey - breeding flocks and meat production flocks.

Table Antimicrobial susceptibility testing of Salmonella in Pigs

Salmonella	S. Enteritidis		S. Typhimurium		S. 1,4,[5],12:i:-		S. Derby		Salmonella spp.		S. Infantis		S. Kedougou		S. Typhimurium, monophasic - DT 120		S. Worthington	
Isolates out of a monitoring program (yes/no)											yes		yes		yes		yes	
Number of isolates available in the laboratory											2		1		3		4	
Antimicrobials:	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n
Amphenicols - Chloramphenicol											2	0	1	0	3	0	4	0
Cephalosporins - 3rd generation cephalosporins											2	0	1	0	3	0	4	0
Fluoroquinolones - Ciprofloxacin											2	0	1	0	3	0	4	0
Penicillins - Ampicillin											2	0	1	1	3	0	4	0
Quinolones - Nalidixic acid											2	0	1	0	3	0	4	0
Trimethoprim + Sulfonamides											2	0	1	1	3	0	4	0
Fully sensitive											2	0			3	0	4	0
Resistant to 2 antimicrobials													1	1				

Footnote:

When interpreting S or R, clinical cut-off values are used.

Table Antimicrobial susceptibility testing of Salmonella in meat from pig

Salmonella	S. Enteritidis		S. Typhimurium		S. 1,4,[5],12:i:-		S. Derby		Salmonella spp.		S. Sandiego		S. Worthington	
Isolates out of a monitoring program (yes/no)	yes										yes		yes	
Number of isolates available in the laboratory	1										2		1	
Antimicrobials:	N	n	N	n	N	n	N	n	N	n	N	n	N	n
Amphenicols - Chloramphenicol	1	0									2	0	1	0
Cephalosporins - 3rd generation cephalosporins	1	0									2	0	1	0
Fluoroquinolones - Ciprofloxacin	1	0									2	0	1	0
Penicillins - Ampicillin	1	0									2	0	1	0
Quinolones - Nalidixic acid	1	0									2	0	1	0
Trimethoprim + Sulfonamides	1	0									2	0	1	0
Fully sensitive	1	0									2	0	1	0

Footnote:

When interpreting S or R, clinical cut-off values are used.

Table Antimicrobial susceptibility testing of Salmonella in meat from broilers (Gallus gallus)

Salmonella	S. Enteritidis		S. Typhimurium		S. 1,4,[5],12:i:-		S. Paratyphi B var. Java		Salmonella spp.		S. Infantis	
Isolates out of a monitoring program (yes/no)											yes	
Number of isolates available in the laboratory											8	
Antimicrobials:	N	n	N	n	N	n	N	n	N	n	N	n
Amphenicols - Chloramphenicol											8	0
Cephalosporins - 3rd generation cephalosporins											8	0
Fluoroquinolones - Ciprofloxacin											8	0
Penicillins - Ampicillin											8	1
Quinolones - Nalidixic acid											8	0
Sulfonamides											8	0
Trimethoprim											8	0
Fully sensitive											7	0
Resistant to 1 antimicrobial											1	0

Table Antimicrobial susceptibility testing of Salmonella in meat from other poultry species

Salmonella	S. Enteritidis		S. Typhimurium		S. 1,4,[5],12:i:-		Salmonella spp.		S. Montevideo	
Isolates out of a monitoring program (yes/no)									yes	
Number of isolates available in the laboratory									1	
Antimicrobials:	N	n	N	n	N	n	N	n	N	n
Amphenicols - Chloramphenicol									1	0
Cephalosporins - 3rd generation cephalosporins									1	0
Fluoroquinolones - Ciprofloxacin									1	0
Penicillins - Ampicillin									1	0
Quinolones - Nalidixic acid									1	0
Sulfonamides									1	0
Trimethoprim									1	0
Fully sensitive									1	0

Table Antimicrobial susceptibility testing of Salmonella in Gallus gallus (fowl) - broilers

Salmonella	S. Enteritidis		S. Typhimurium		S. 1,4,[5],12:i:-		S. Paratyphi B var. Java		Salmonella spp.		S. Agona		S. Infantis	
Isolates out of a monitoring program (yes/no)											yes		yes	
Number of isolates available in the laboratory											13		1	
Antimicrobials:	N	n	N	n	N	n	N	n	N	n	N	n	N	n
Amphenicols - Chloramphenicol											13	0	1	0
Cephalosporins - 3rd generation cephalosporins											13	0	1	0
Fluoroquinolones - Ciprofloxacin											13	0	1	0
Penicillins - Ampicillin											13	0	1	0
Quinolones - Nalidixic acid											13	0	1	0
Sulfonamides											13	0	1	0
Trimethoprim											13	0	1	0
Fully sensitive											13	0	1	0

Table Cut-off values for antibiotic resistance testing of Salmonella in Animals

Test Method Used	Standard methods used for testing
Disc diffusion	NCCLS/CLSI

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin	EFSA	2	
	Streptomycin	EFSA	32	
Amphenicols	Chloramphenicol	EFSA	16	12
Cephalosporins	3rd generation cephalosporins			19
	Cefotaxime	EFSA	0.5	
Fluoroquinolones	Ciprofloxacin	EFSA	0.06	20
Penicillins	Ampicillin	EFSA	4	13
Quinolones	Nalidixic acid	EFSA	16	13
Sulfonamides	Sulfonamides	EFSA	256	
Tetracyclines	Tetracycline	EFSA	8	
Trimethoprim	Trimethoprim	EFSA	2	
Trimethoprim + Sulfonamides	Trimethoprim + Sulfonamides			10

Table Cut-off values for antibiotic resistance testing of Salmonella in Animals

Footnote:

Clinical cut-off values.

Table Cut-off values for antibiotic resistance testing of Salmonella in Feed

Test Method Used	Standard methods used for testing
Disc diffusion	NCCLS/CLSI

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin	EFSA	2	
	Streptomycin	EFSA	32	
Amphenicols	Chloramphenicol	EFSA	16	12
Cephalosporins	3rd generation cephalosporins			19
	Cefotaxime	EFSA	0.5	
Fluoroquinolones	Ciprofloxacin	EFSA	0.06	20
Penicillins	Ampicillin	EFSA	4	13
Quinolones	Nalidixic acid	EFSA	16	13
Sulfonamides	Sulfonamides	EFSA	256	
Tetracyclines	Tetracycline	EFSA	8	
Trimethoprim	Trimethoprim	EFSA	2	
Trimethoprim + Sulfonamides	Trimethoprim + Sulfonamides			10

Table Cut-off values for antibiotic resistance testing of Salmonella in Feed

Table Cut-off values for antibiotic resistance testing of Salmonella in Food

Test Method Used	Standard methods used for testing
Disc diffusion	NCCLS/CLSI

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin	EFSA	2	
	Streptomycin	EFSA	32	
Amphenicols	Chloramphenicol	EFSA	16	12
Cephalosporins	3rd generation cephalosporins			19
	Cefotaxime	EFSA	0.5	
Fluoroquinolones	Ciprofloxacin	EFSA	0.06	20
Penicillins	Ampicillin	EFSA	4	13
Quinolones	Nalidixic acid	EFSA	16	13
Sulfonamides	Sulfonamides	EFSA	256	
Tetracyclines	Tetracycline	EFSA	8	
Trimethoprim	Trimethoprim	EFSA	2	
Trimethoprim + Sulfonamides	Trimethoprim + Sulfonamides			10

Table Cut-off values for antibiotic resistance testing of Salmonella in Food

Footnote:

Clinical cut-off values.

2.2 CAMPYLOBACTERIOSIS

2.2.1 General evaluation of the national situation

A. Thermophilic Campylobacter general evaluation

History of the disease and/or infection in the country

Icelandic studies have shown that many species of wild birds, farmed animals and pets are frequent carriers of a thermophilic Campylobacter spp. A pilot study done in 1999 (July-Oct) showed that 25% of broiler flocks in Iceland were infected and that the prevalence in broiler meat on the market in Iceland was 45%.

In 1998 the incidence of campylobacteriosis in humans began to increase, from 34,5 in 1997 to 79,8 in 1998. In 1999 the incidence was 155,9, where 116,8 were identified as being of domestic origin. In 1996 it was authorized for the first time to sell and distribute chilled broiler meat, where in the decades before only frozen broiler meat had been available and no poultry meat was imported to Iceland. Following the marketing of chilled broiler meat the yearly consumption increased from 6 kg pr. Inhabitant in 1996 to 11 kg pr. Inhabitant in 1999. Icelandic veterinary and human health authorities came to the conclusion that the major increase of human campylobacteriosis in Iceland in 1999 was linked to the consumption and handling of chilled broiler meat.

In cooperation with the poultry industry in Iceland the authorities implemented a national surveillance programme for Campylobacter in poultry. It began as a voluntary programme in May 2000, but by late 2001 and early 2002 it was implemented into national legislation. The objective of the programme is to prevent the distribution of chilled poultry carcasses or poultry meat that is known to be Campylobacter positive.

Therefore all positive poultry flocks and all positive slaughter batches are either frozen or heat treated before distribution, however as the results from the slaughter samples are not available until two days after slaughter, campylobacter positive carcasses or chilled meat can occasionally be distributed, (approx. 4,5% of the total broiler production). Only carcasses from poultry flocks that are negative prior to slaughter can be distributed from the slaughterhouses as chilled meat.

The Icelandic consumer prefers chilled poultry meat to frozen and is willing to pay more for it. In Iceland there are three poultry companies and each company owns allt the establishments throughout the processing chain (i.e. the hatchery, farm, slaughterhouse, cutting plant and processing plants for meat and ready-to-eat products).

With regard to the surveillance programme the poultry companies have to produce Campylobacter negative broilers if they want to sell and distribute chilled broiler meat, as all Campylobacter positive broilers must be frozen or heat-treated before distribution and marketing. This is why the Icelandic surveillance programme is the driving force for all on farm efforts to eradicate Campylobacter; see Chapter on Campylobacter in Gallus gallus.

National evaluation of the recent situation, the trends and sources of infection

After the implementation of the national surveillance programme in 2000 the prevalence in broiler flocks, slaughter groups and the incidence in humans decreased dramatically. The Campylobacter trend in the last decade has been that it is decreasing in all three stages (i.e. in broilers, slaughter batches and humans).

Before the implementation of the surveillance programme the prevalence in broiler flocks was about 25%. However, in recent years it has been as follows: 4,5% (2005), 9,5% (2006), 6,3% (2007), 8,5% (2008), 4,2% (2009) and 7,0% (2010).

Before the implementation of the surveillance programme the prevalence in broiler meat on the market was about 45%. However, in recent years the prevalence in broiler slaughter batches has been as follows: 10,4% (2005), 12,3% (2006), 8,9% (2007), 11,6% (2008), 7,5% (2009) and 13,2% (2010).

It is assumed that the implementation of the surveillance programme has decreased the human incidence of campylobacteriosis which now varies between 29,5 to 77,8, where between 10,4 to 42,6 are identified as of domestic origin (2001-2008). These results have been achieved despite the fact that yearly consumption of broiler meat has increased from 6 kg pr. inhabitant in 1996 to 24 kg pr. inhabitant in 2009 and that approximately 70% of all broiler meat on the market is sold chilled. Hardly any broiler meat is imported and only frozen products can be imported.

The Icelandic national surveillance programme has since its implementation prevented large quantities of Campylobacter positive broiler meat from entering the market as chilled meat. The programme is assumed to be very effective to reduce Campylobacter in broilers and campylobacteriosis in humans, by preventing as much as possible that consumers get in contact with or handle positive chilled poultry meat.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

Consumption and handling of poultry and poultry products is not believed to be the primary source of human campyloabacteriosis in Iceland any longer. The use of untreated water, especially in summerhouses and during camping, is however believed to be an important source of human campylobacteriosis in Iceland.

Recent actions taken to control the zoonoses

The implementation of the Icelandic surveillance programme for Campylobacter in poultry was a direct response from the food and veterinary authority and the poultry industry to the major increase in human campylobacteriosis in 1999. The programme is almost the same as it was when implemented in 2000 and only minor changes have been made. The national surveillance programme is believed to be very effective in preventing campylobacteriosis in humans.

2.2.2 Campylobacter in foodstuffs

A. Thermophilic Campylobacter in Broiler meat and products thereof

Monitoring system

Sampling strategy

At slaughterhouse and cutting plant

According to the Icelandic Campylobacter national surveillance programme every poultry slaughter batch (slaughter group) is sampled at the slaughter line before chilling. The samples are taken by the official veterinarian (OV).

Frequency of the sampling

At slaughterhouse and cutting plant

Every batch is sampled

Type of specimen taken

At slaughterhouse and cutting plant

Caeca samples

Methods of sampling (description of sampling techniques)

At slaughterhouse and cutting plant

2 x 10 caecae are sampled at the slaughter line, pooled to 2 samples at the laboratory.

Definition of positive finding

At slaughterhouse and cutting plant

A slaughter batch where Campylobacter spp. is detected.

Diagnostic/analytical methods used

At slaughterhouse and cutting plant

Bacteriological method: Campy-Cefex direct plate Method

Preventive measures in place

According to the Campylobacter national surveillance programme, all broiler flocks are tested before slaughter and flocks that are found to be positive before slaughter are subjected to either freezing or heat treatment. According to national legislation there has to be a warning note on each package containing raw poultry meat. This note warns the consumer against cross contamination when handling raw poultry meat.

Control program/mechanisms

The control program/strategies in place

See chapter on Campylobacter in Gallus gallus.

Recent actions taken to control the zoonoses

The Campylobacter national surveillance programme has been running almost the same since the year 2000 and is believed to be very effective to protect humans against campylobacteriosis.

Measures in case of the positive findings or single cases

Broiler carcasses and meat from slaughter batches that test positive for thermophilic Campylobacter sp. during slaughter sampling are subjected to either freezing or heat treatment.

Notification system in place

All results from samples taken from slaughter batches are as a part of the surveillance programme reported directly to the authorities from the laboratories, both negative and positive results.

Results of the investigation

The prevalence of Campylobacter sp. in broiler slaughter batches in 2011 was 8,6%, which is similar to the results from previous years.

National evaluation of the recent situation, the trends and sources of infection

The trend in the last decade has been that the Campylobacter prevalence in broiler slaughter batches is decreasing.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

See chapter on Campylobacter in Gallus gallus.

2.2.3 Campylobacter in animals

A. Thermophilic Campylobacter in Gallus gallus

Monitoring system

Sampling strategy

According to the Icelandic Campylobacter national surveillance programme every broiler flock is sampled at the farm 2 to 5 days prior to slaughter. Other poultry flocks are sampled 14 days prior to slaughter. Samples are taken by the food business operator (FBO).

Frequency of the sampling

Before slaughter at farm

Every flock is sampled by the FBO

At slaughter

Every batch is sampled by the OV

Type of specimen taken

Before slaughter at farm

Faeces

At slaughter

Other: caecum by the OV

Methods of sampling (description of sampling techniques)

Before slaughter at farm

10 individual fresh faecal droppings are taken by the FBO 2 to 5 days before slaughter. They are transported as one pooled sample to the laboratory.

At slaughter

2 x 10 caecae are sampled at the slaughter line by the OV, pooled to 2 samples at the laboratory.

Case definition

Before slaughter at farm

A flock is considered positive when Campylobacter spp. is detected.

At slaughter

A slaughter batch is considered positive when Campylobacter spp. is detected.

Diagnostic/analytical methods used

Before slaughter at farm

Bacteriological method: Campy-Cefex direct plate Method

At slaughter

Bacteriological method: Campy-Cefex direct plate Method

Vaccination policy

There is no vaccination against Campylobacter in Iceland.

Other preventive measures than vaccination in place

Generally the Icelandic national Campylobacter surveillance programme is the driving force for all preventive measures at the farm level, as all positive flocks must be either frozen or heat treated directly after slaughter. As only flocks that test negative for Campylobacter prior to slaughter can be processed as fresh chilled products the farmers aim to produce negative flocks, as the fresh chilled products have the highest market value.

The most important intervention done at the farm level is no thinning and very high biosecurity all year round. In 2005 many farmers began to slaughter the broilers at a younger age (approx. 30 days) during the summer period (June-September) but the rest of the year they slaughtered them at the age of approx. 36 days, where as younger broilers have lower campylobacter prevalence. The latest preventative measure (since 2008) is to use fly nets on the broiler house inlets during the summer period on high risk farms (i.e. where they cannot use the “all in - all out” method at the farm level).

All preventative measures at the farm level are voluntary interventions.

Control program/mechanisms

The control program/strategies in place

The Campylobacter national surveillance programme is based on Reg. no. 260/1980 (amended by Reg. no 688/2002) and Reg. no. 251/1995 (amended by Reg. no 904/2001). The Icelandic Campylobacter surveillance programme is called the „Freezing Policy“ which means that all positive poultry flocks and all positive slaughter batches are submitted to freezing or are heat treated before distribution, however as the results from the slaughter samples are not available until two days after slaughter, campylobacter positive carcasses or chilled meat can occasionally be distributed, (approx. 4,5% of the total broiler production). Only carcasses from poultry flocks that are negative prior to slaughter can be processed as chilled meat from the slaughterhouses. The objective of the programme is to prevent distribution of poultry carcasses or poultry meat that is known to be Campylobacter positive as chilled products.

The surveillance programme started in the year 2000 as a voluntary programme in collaboration with the poultry industry. In 2002 it was implemented into national legislation.

Recent actions taken to control the zoonoses

The Campylobacter national surveillance programme has been running almost the same since the year 2000 and is believed to be very effective to protect humans against campylobacteriosis.

Measures in case of the positive findings or single cases

Carcasses from flocks that test positive for thermophilic Campylobacter sp. based upon the pre-slaughter sampling are either subjected to heat-treatment or frozen.

Notification system in place

All results from samples taken from broiler flocks are as a part of the surveillance programme reported directly to the authorities from the laboratories, both negative and positive results.

Results of the investigation

The prevalence of Capmylobacter sp. in broiler flocks in 2011 was 5,3% which is similar to the results from previous years.

National evaluation of the recent situation, the trends and sources of infection

The trend in the last decade has been that the Campylobacter prevalence in broiler flocks is decreasing.

Relevance of the findings in animals to findings in foodstuffs and to human cases (as a source of infection)

Consumption and handling of poultry and poultry products is not believed to be the primary source of human campyloabacteriosis in Iceland any longer. There is a strong seasonal variation with a peak occurring during the summer and autumn months both in broilers and humans, while very low prevalence/incidences can be found during the winter months. The Icelandic food and veterinary authority collects monthly poultry production data with regard to campylobacter. This enables calculations of the possible maximum amounts of Campylobacter positive broiler meat that might have been distributed as chilled products on the market each month. However when compared to human campyloabacteriosis during the same period, it has been shown that in months where no Campylobacter positive chilled broiler meat was distributed on the market there were still some cases of campylobacteriosis of domestic origin. This indicates that other sources of Campylobacter sp. are important.

Table Campylobacter in animals

	Source of information	Sampling strategy	Sampler	Sample type	Sample Origin	Sampling unit	Units tested	Total units positive for Campylobacter	C. coli	C. jejuni	C. lari
Gallus gallus (fowl) - broilers - at farm - Monitoring	Keldur, Matís	Census	Industry sampling	animal sample > faeces		Flock	628	33			
Gallus gallus (fowl) - broilers - at slaughterhouse - Monitoring	Keldur	Census	Official sampling	animal sample > caecum		Slaughter batch	695	60			
Turkeys - at farm - Monitoring	Keldur	Census	Industry sampling	animal sample > faeces		Flock	23	0			
Turkeys - at slaughterhouse - Monitoring	Keldur	Census	Official sampling	food sample > neck skin		Slaughter batch	25	1			
Ducks - at farm - Monitoring	Keldur	Census	Industry sampling	animal sample > faeces		Flock	25	25			

	C. upsaliensis	Thermophilic Campylobacter spp., unspecified
Gallus gallus (fowl) - broilers - at farm - Monitoring		33
Gallus gallus (fowl) - broilers - at slaughterhouse - Monitoring		60
Turkeys - at farm - Monitoring		0
Turkeys - at slaughterhouse - Monitoring		1
Ducks - at farm - Monitoring		25

Table Campylobacter in animals

2.2.4 Antimicrobial resistance in Campylobacter isolates

Table Cut-off values used for antimicrobial susceptibility testing of C. coli in Animals

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		2	
	Streptomycin		4	
Fluoroquinolones	Ciprofloxacin		1	
Macrolides	Erythromycin		16	
Tetracyclines	Tetracycline		2	

Table Cut-off values used for antimicrobial susceptibility testing of C. coli in Feed

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		2	
	Streptomycin		4	
Fluoroquinolones	Ciprofloxacin		1	
Macrolides	Erythromycin		16	
Tetracyclines	Tetracycline		2	

Table Cut-off values used for antimicrobial susceptibility testing of C. coli in Food

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		2	
	Streptomycin		4	
Fluoroquinolones	Ciprofloxacin		1	
Macrolides	Erythromycin		16	
Tetracyclines	Tetracycline		2	

Table Cut-off values used for antimicrobial susceptibility testing of C. jejuni in Animals

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		1	
	Streptomycin		2	
Fluoroquinolones	Ciprofloxacin		1	
Macrolides	Erythromycin		4	
Tetracyclines	Tetracycline		2	

Table Cut-off values used for antimicrobial susceptibility testing of C. jejuni in Feed

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		1	
	Streptomycin		2	
Fluoroquinolones	Ciprofloxacin		1	
Macrolides	Erythromycin		4	
Tetracyclines	Tetracycline		2	

Table Cut-off values used for antimicrobial susceptibility testing of C. jejuni in Food

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		1	
	Streptomycin		2	
Fluoroquinolones	Ciprofloxacin		1	
Macrolides	Erythromycin		4	
Tetracyclines	Tetracycline		2	

2.3 LISTERIOSIS

2.3.1 General evaluation of the national situation

2.4 E. COLI INFECTIONS

2.4.1 General evaluation of the national situation

2.5 TUBERCULOSIS, MYCOBACTERIAL DISEASES

2.5.1 General evaluation of the national situation

2.6 BRUCELLOSIS

2.6.1 General evaluation of the national situation

2.7 YERSINIOSIS

2.7.1 General evaluation of the national situation

2.8 TRICHINELLOSIS

2.8.1 General evaluation of the national situation

A. Trichinellosis general evaluation

History of the disease and/or infection in the country

Regular or systematic surveillance of Trichinella sp. has not been done so far in Iceland, but as of January 1st 2012 samples are taken from all slaughtered pigs and horses according to Commission Regulation (EC) No 2075/2005.

When particularly looked for Trichinella has neither been found in live stock nor in domestic wild animals (foxes, minks) in Iceland. Three cases of Trichinella sp. in stray polar bears are known from the years 1963, 2008 and 2010. In 1963 Trcihinella sp. was found in a stray polar bear which came ashore in the north-western part of the country, in 2008 Trichinella native was found in another polar bear that came ashore in the northern part of the country and in 2010 Trichinella sp. was found in the third animal which was detected in the north-eastern part of Iceland.

When exporting horse meat some purchasers demand Trichinella testing at slaughter and prior to export. As a result of these demands approx. 1.600 samples from horses had been investigated up until the year

2008, which were negative with regard to Trichinella sp.

Trichinella has never been diagnosed in humans in Iceland.

National evaluation of the recent situation, the trends and sources of infection

The risk of Trichinella spp. beeing introduced into Icelandic wildlife does exists because of occasional stray polar bears coming ashore. The probability of the risk is however very low because polar bears are euthanized and their carcasses removed as soon as they are detected.

Relevance of the findings in animals, feedingstuffs and foodstuffs to human cases (as a source of infection)

The probability of contracting trichinellosis from food producing animals of Icelandic origin is close to zero.

Recent actions taken to control the zoonoses

None, other than euthanizing and removing polar bears from the environment and disposing of the carcasses after post-mortem investigations.

2.8.2 Trichinella in animals

A. Trichinella in horses

Monitoring system

Sampling strategy

Samples were only taken from horses intended for export.

Frequency of the sampling

Samples were taken from all horses intended for export.

Type of specimen taken

Tongue or masseter muscle.

Methods of sampling (description of sampling techniques)

Methods used were in accordance with Regulation (EC) No 2075/2005. For analyses, 5 g per animal is included in a pooled sample of maximum 100 g.

Case definition

An animal with a positive test result in the official examination.

Diagnostic/analytical methods used

Artificial digestion method of pooled samples.

Results of the investigation including the origin of the positive animals

No cases of Trichinellosis were reported among slaughtered horses intended for export.

Control program/mechanisms

The control program/strategies in place

Sampling was done on demand from purchasers.

Measures in case of the positive findings or single cases

In case of a positive sample the horse carcasses will be retested individually. Pursuant to the Law on Animal Health No 25/1993, the Minister can issue national regulation on any necessary measures to be taken in order to find the source of the infection, restrict movement of animals, hinder the spread of and eradicate the disease.

Notification system in place

According to the national Law on Animal Health, no. 25/1993, trichinellosis is a list B disease that must be notified.

National evaluation of the recent situation, the trends and sources of infection

No cases have been reported in Iceland, neither in humans nor in animals.

Table Trichinella in animals

	Source of information	Sampling strategy	Sampler	Sample type	Sample Origin	Sampling unit	Units tested	Total units positive for Trichinella	T. spiralis	Trichinella spp., unspecified
Solipeds, domestic - horses - at slaughterhouse - Surveillance [1)]	Keldur	Census	Official sampling	animal sample > organ/tissue		Animal	3105	0	0	0

Comments:

[1)] Export of horse meat

2.9 ECHINOCOCCOSIS

2.9.1 General evaluation of the national situation

2.10 TOXOPLASMOSIS

2.10.1 General evaluation of the national situation

2.11 RABIES

2.11.1 General evaluation of the national situation

2.12 STAPHYLOCOCCUS INFECTION

2.12.1 General evaluation of the national situation

2.13 Q-FEVER

2.13.1 General evaluation of the national situation

3. INFORMATION ON SPECIFIC INDICATORS OF ANTIMICROBIAL RESISTANCE

3.1 ESCHERICHIA COLI, NON-PATHOGENIC

3.1.1 General evaluation of the national situation

3.1.2 Antimicrobial resistance in Escherichia coli, non-pathogenic

Table Cut-off values used for antimicrobial susceptibility testing of Escherichia coli, non-pathogenic in Animals

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		2	
	Streptomycin		16	
Amphenicols	Chloramphenicol		16	
Cephalosporins	Cefotaxime		0.25	
Fluoroquinolones	Ciprofloxacin		0.03	
Penicillins	Ampicillin		8	
Quinolones	Nalidixic acid		16	
Sulfonamides	Sulfonamides		256	

Table Cut-off values used for antimicrobial susceptibility testing of Escherichia coli, non-pathogenic in Animals

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Tetracyclines	Tetracycline		8	
Trimethoprim	Trimethoprim		2	

Table Cut-off values used for antimicrobial susceptibility testing of Escherichia coli, non-pathogenic in Feed

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		2	
	Streptomycin		16	
Amphenicols	Chloramphenicol		16	
Cephalosporins	Cefotaxime		0.25	
Fluoroquinolones	Ciprofloxacin		0.03	
Penicillins	Ampicillin		8	
Quinolones	Nalidixic acid		16	
Sulfonamides	Sulfonamides		256	
Tetracyclines	Tetracycline		8	
Trimethoprim	Trimethoprim		2	

Table Cut-off values used for antimicrobial susceptibility testing of Escherichia coli, non-pathogenic in Food

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		2	
	Streptomycin		16	
Amphenicols	Chloramphenicol		16	
Cephalosporins	Cefotaxime		0.25	
Fluoroquinolones	Ciprofloxacin		0.03	
Penicillins	Ampicillin		8	
Quinolones	Nalidixic acid		16	
Sulfonamides	Sulfonamides		256	
Tetracyclines	Tetracycline		8	
Trimethoprim	Trimethoprim		2	

3.2 ENTEROCOCCUS, NON-PATHOGENIC

3.2.1 General evaluation of the national situation

3.2.2 Antimicrobial resistance in Enterococcus, non-pathogenic isolates

Table Cut-off values for antibiotic resistance of E. faecalis in Animals

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		32	
	Streptomycin		512	
Amphenicols	Chloramphenicol		32	
Glycopeptides (Cyclic peptides, Polypeptides)	Vancomycin		4	
Macrolides	Erythromycin		4	
Oxazolidines	Linezolid		4	
Penicillins	Ampicillin		4	
Streptogramins	Quinupristin/Dalfopristin		32	

Table Cut-off values for antibiotic resistance of E. faecalis in Animals

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Tetracyclines	Tetracycline		2	

Table Cut-off values for antibiotic resistance of E. faecalis in Feed

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		32	
	Streptomycin		512	
Amphenicols	Chloramphenicol		32	
Glycopeptides (Cyclic peptides, Polypeptides)	Vancomycin		4	
Macrolides	Erythromycin		4	
Oxazolidines	Linezolid		4	
Penicillins	Ampicillin		4	
Streptogramins	Quinupristin/Dalfopristin		32	
Tetracyclines	Tetracycline		2	

Table Cut-off values for antibiotic resistance of E. faecalis in Food

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		32	
	Streptomycin		512	
Amphenicols	Chloramphenicol		32	
Glycopeptides (Cyclic peptides, Polypeptides)	Vancomycin		4	
Macrolides	Erythromycin		4	
Oxazolidines	Linezolid		4	
Penicillins	Ampicillin		4	
Streptogramins	Quinupristin/Dalfopristin		32	
Tetracyclines	Tetracycline		2	

Table Cut-off values for antibiotic resistance of E. faecium in Animals

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		32	
	Streptomycin		128	
Amphenicols	Chloramphenicol		32	
Glycopeptides (Cyclic peptides, Polypeptides)	Vancomycin		4	
Macrolides	Erythromycin		4	
Oxazolidines	Linezolid		4	
Penicillins	Ampicillin		4	
Streptogramins	Quinupristin/Dalfopristin		1	
Tetracyclines	Tetracycline		2	

Table Cut-off values for antibiotic resistance of E. faecium in Feed

Test Method Used	Standard methods used for testing

			Concentration (microg/ml)	Zone diameter (mm)
		Standard	Resistant >	Resistant <=
Aminoglycosides	Gentamicin		32	
	Streptomycin		128	
Amphenicols	Chloramphenicol		32	
Glycopeptides (Cyclic peptides, Polypeptides)	Vancomycin		4	
Macrolides	Erythromycin		4	
Oxazolidines	Linezolid		4	
Penicillins	Ampicillin		4	
Streptogramins	Quinupristin/Dalfopristin		1	
Tetracyclines	Tetracycline		2	

Table Cut-off values for antibiotic resistance of E. faecium in Food

Test Method Used	Standard methods used for testing

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	Streptomycin		128	
Amphenicols	Chloramphenicol		32	
Glycopeptides (Cyclic peptides, Polypeptides)	Vancomycin		4	
Macrolides	Erythromycin		4	
Oxazolidines	Linezolid		4	
Penicillins	Ampicillin		4	
Streptogramins	Quinupristin/Dalfopristin		1	
Tetracyclines	Tetracycline		2	

4. INFORMATION ON SPECIFIC MICROBIOLOGICAL AGENTS

4.1 ENTEROBACTER SAKAZAKII

4.1.1 General evaluation of the national situation

4.2 HISTAMINE

4.2.1 General evaluation of the national situation

4.3 STAPHYLOCOCCAL ENTEROTOXINS

4.3.1 General evaluation of the national situation

5. FOODBORNE

Foodborne outbreaks are incidences of two or more human cases of the same disease or infection where the cases are linked or are probably linked to the same food source. Situation, in which the observed human cases exceed the expected number of cases and where a same food source is suspected, is also indicative of a foodborne outbreak.

Table Foodborne Outbreaks: summarised data

	Weak evidence or no vehicle outbreaks					
	Number of outbreaks	Human cases	Hospitalized	Deaths	Strong evidence Number of Outbreaks	Total number of outbreaks
Salmonella - S. Typhimurium	0	unknown	unknown	unknown	0	0
Salmonella - S. Enteritidis	0	unknown	unknown	unknown	0	0
Salmonella - Other serovars	0	unknown	unknown	unknown	0	0
Campylobacter	0	unknown	unknown	unknown	0	0
Listeria - Listeria monocytogenes	0	unknown	unknown	unknown	0	0
Listeria - Other Listeria	0	unknown	unknown	unknown	0	0
Yersinia	0	unknown	unknown	unknown	0	0
Escherichia coli, pathogenic - Verotoxigenic E. coli (VTEC)	0	unknown	unknown	unknown	0	0
Bacillus - B. cereus	0	unknown	unknown	unknown	0	0
Bacillus - Other Bacillus	0	unknown	unknown	unknown	0	0
Staphylococcal enterotoxins	0	unknown	unknown	unknown	0	0
Clostridium - Cl. botulinum	0	unknown	unknown	unknown	0	0
Clostridium - Cl. perfringens	0	unknown	unknown	unknown	0	0

	Weak evidence or no vehicle outbreaks					
	Number of outbreaks	Human cases	Hospitalized	Deaths	Strong evidence Number of Outbreaks	Total number of outbreaks
Clostridium - Other Clostridia	0	unknown	unknown	unknown	0	0
Other Bacterial agents - Brucella	0	unknown	unknown	unknown	0	0
Other Bacterial agents - Shigella	0	unknown	unknown	unknown	0	0
Other Bacterial agents - Other Bacterial agents	0	unknown	unknown	unknown	0	0
Parasites - Trichinella	0	unknown	unknown	unknown	0	0
Parasites - Giardia	0	unknown	unknown	unknown	0	0
Parasites - Cryptosporidium	0	unknown	unknown	unknown	0	0
Parasites - Anisakis	0	unknown	unknown	unknown	0	0
Parasites - Other Parasites	0	unknown	unknown	unknown	0	0
Viruses - Norovirus	0	unknown	unknown	unknown	0	0
Viruses - Hepatitis viruses	0	unknown	unknown	unknown	0	0
Viruses - Other Viruses	0	unknown	unknown	unknown	0	0
Other agents - Histamine	0	unknown	unknown	unknown	0	0
Other agents - Marine biotoxins	0	unknown	unknown	unknown	0	0
Other agents - Other Agents	0	unknown	unknown	unknown	0	0

	Weak evidence or no vehicle outbreaks					
	Number of outbreaks	Human cases	Hospitalized	Deaths	Strong evidence Number of Outbreaks	Total number of outbreaks
Unknown agent	0	unknown	unknown	unknown	0	0