



# The surveillance programme for *Salmonella* spp. in live animals, eggs and meat in Norway 2023



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## Summary

The *Salmonella* surveillance programmes in 2023 documents that the Norwegian population of cattle, swine and poultry are only sporadically infected. The estimated prevalence is below 0.1% in all examined populations.

## Introduction

The occurrence of *Salmonella* in Norwegian production animals and animal products is very low compared to most other countries, and has been so during the last decades (1).

The number of confirmed cases of human salmonellosis has decreased in Europe over the past 10 years. The reduced prevalence of *Salmonella* in European poultry is presumed to contribute to the observed reduction. The number of cases infected in Norway has remained relatively stable in the last 10 years but decreased in 2020 and 2021, probably due to measurements against the COVID-19 pandemic in Norway. The number increased again in 2022, but is still lower than before the pandemic. This is mainly due to a decrease in the number of travel associated cases (1).

As it is very important to maintain this favourable situation in Norway, the Norwegian *Salmonella* surveillance programmes (2) were established in 1995, and launched simultaneously with comparable programmes in Sweden and Finland (3,4). The program for poultry was revised and updated in 2006. The programmes are approved by the EU Commission (5), allowing Norway to require additional guarantees regarding *Salmonella* when importing live animals and food products of animal origin from the European Union.

The Norwegian Food Safety Authority (NFSA) is responsible for implementing the surveillance programmes according to the regulations (6,7,8). The Norwegian Veterinary Institute coordinates the surveillance programmes, examines the faecal samples and reports the results. Approved commercial laboratories perform the examination of samples collected at slaughterhouses and cutting plants.

Any *Salmonella* isolated in the programmes, irrespective of serovar, is notifiable to the NFSA. When *Salmonella* is isolated, action is taken to eliminate the infection, prevent transmission, and prevent contamination of food products.

## Aims

The aims of the programmes are to ensure that Norwegian food-producing animals and food products of animal origin are virtually free from *Salmonella*, to provide reliable documentation of the prevalence of *Salmonella* in the livestock populations and their products, and to prevent an increased occurrence of *Salmonella* in Norway.

## Materials and methods

The *Salmonella* surveillance programme for live animals includes examination of faecal samples (including boot swabs) from swine and poultry, and lymph node samples from cattle and swine (at least five ileo-caecal lymph nodes from each animal) and environmental samples from adult breeding flocks and broilers.

The *Salmonella* surveillance programme for fresh meat includes examination of swab samples from cattle and swine carcasses, and samples of crushed meat from red meat cutting plants and cold stores.

The number of samples requested in the different parts of the programmes is estimated to be sufficient to detect at least one *Salmonella* positive sample if the prevalence in the population is at least 0.1%, with a confidence level of 95%, assuming a 100% sensitive test.

### Sampling scheme for live animals

#### *Poultry*

The present *Salmonella* programme has been established pursuant to Article 5 of regulation (EC) 2160/2003 of the European Parliament and of the Council of 17 November 2003 on the control of *Salmonella* and other specified food-borne zoonotic agents (6).

All breeder flocks and commercial production flocks are included in the surveillance programme. All breeder flocks are sampled in accordance with Table 1. All layer flocks are sampled twice during the rearing period and every 15 weeks during the egg laying period (Table 1), whilst broiler flocks and flocks of turkeys, ducks and geese other than breeders are sampled one to three weeks before slaughter (Table 1). Result of the testing must be available before slaughter so actions can be taken in positive flocks.

*Table 1: Sampling scheme in the surveillance programme for Salmonella in Gallus gallus, turkey, duck, geese and guinea fowls in breeder flocks and flocks in production. All samples are collected in the holding.*

Production	Sampling time	Sample material	Sampling by*
<b>Breeder flocks</b>			
Rearing flocks	Day old	5 transport crates from one delivery: Crate liners (>1m <sup>2</sup> in total) or Swab samples (>1m <sup>2</sup> in total) analysed as one pooled sample.	F
	4 weeks old	2 pairs of boot swabs analysed as one pooled sample.	F
	2 weeks before being moved	2 pairs of boot swabs analysed as one pooled sample.	O: Once a year per holding F: Remaining samples
Adult flocks	Every 2 <sup>nd</sup> week	1 pair of boot swabs and 1 specimen of dust (cloth). Analysed as two separate samples. [2 x 150 g faeces analysed separately, if birds kept in cages].	2 x O: 0-4 weeks after moving, 8-0 weeks before slaughter, once in between F: Remaining samples
<b>Production flocks</b>			
Pullets	Day old	5 transport crates: Crate liners (>1m <sup>2</sup> in total) or Swab samples (>1m <sup>2</sup> in total) analysed as one pooled sample.	F
	2 weeks before being moved	2 pairs of boot swabs analysed as one pooled sample. Cage birds: Faecal samples (150 g)	O: Once a year in each holding F: Remaining samples
Layers	Every 15 <sup>th</sup> week	2 pairs of boot swabs analysed as one pooled sample. Cage birds: Faecal samples (2x150 g).	O: One of the samples F: Remaining samples
Slaughter flocks	10 - 19 days before slaughter	1 pair of boot swabs and 1 specimen of dust (cloth) analysed as one pooled sample.	O: Once a year per holding F: Remaining samples

\*O = Official personnel (Norwegian Food Safety Authority), F = Farmer.

### Swine

In Norway, there were 70 elite and multiplier breeding swine herds at the start of 2024. More than 95% of marketed breeding animals are purchased from these herds. All elite and multiplier breeding herds are surveyed annually at herd level (7). Pooled faecal samples are collected from all pens (up to a maximum of 20) containing piglets aged two to six months. If there are less than three pens of piglets at the time of sampling, additional individual faecal samples are collected from all sows (up to a maximum of 59).

The pig population is surveyed by sampling a representative proportion of all pigs slaughtered in Norway. Lymph node samples from 3,000 swine (both sows and slaughter pigs) should be collected at slaughter. The estimated sample volume for each slaughterhouse ranged from 3 to 710 and is based upon the number of onsite slaughtered animals in relation to the national total. The sampling is distributed evenly throughout the year (7).

### Cattle

The surveillance is based on sampling a representative proportion of all cattle slaughtered in Norway. A total of 3,000 lymph node samples from cattle should be collected at slaughter. The estimated sample volume for each slaughterhouse ranged from 1 to 645 and is based upon the number of onsite slaughtered animals in relation to the national total. The sampling is distributed evenly throughout the year (7).

### *All animal species - clinical cases*

Animals with clinical symptoms consistent with salmonellosis should be sampled for testing. In addition, all sanitary slaughtered animals are tested for the presence of *Salmonella*. Data from these two categories of samples are not included in this report.

## Sampling scheme for fresh meat

### *Swab samples from carcasses*

The testing of slaughtered pigs and cattle for *Salmonella* is done by swabbing carcass surfaces. For each animal species, 3,000 swab samples should be collected at slaughter. The number of swab samples of cattle and swine from each slaughterhouse equals the number of lymph node samples. The sampling is distributed evenly throughout the year. The sampling is done near the end of the slaughter line before the carcasses are refrigerated. Approx. 1,400 cm<sup>2</sup> of each carcass is swabbed (8).

### *Food products*

The surveillance programme for cutting plants and cold stores is based on samples of crushed red meat taken from the equipment or from trimmings. Each sample consists of 25 g. Each production line is sampled separately (but analysed as one pooled sample). The sampling should be performed randomly during operation. The number of samples taken in cutting plants and cold stores is given by the production capacity of the plant, and ranges from one sample per week to two per year (8). Pre-packed fresh meat intended for cold stores does not have to be examined if they come from cutting plants that are included in the programme.

## Laboratory methods

### *Faecal samples (including boot swabs)*

Testing for the presence of *Salmonella* was carried out using VIDAS®SPT, which is an automated qualitative ELISA test for the detection of *Salmonella* in animal faecal- and environmental samples from the primary production stage and based on a novel recombinant phage protein-based technology. The method is validated according to ISO 16140.

### *Lymph nodes, carcass swabs and crushed meat samples*

All lymph nodes from one animal are divided into two equal parts. One-half is used for testing and the other half is stored at 4°C until the results of the bacteriological examination are ready. The lymph nodes from at most five animals are pooled and homogenized before bacteriological examination. Swab samples are pooled in groups of five before testing. If a pooled sample is confirmed positive for *Salmonella*, the individual samples are examined separately. The samples are analysed using real-time PCR. The method is validated according to ISO 16140.

### *All samples*

A sample is considered positive when *Salmonella* is detected by the specified method and the referred isolate is verified by the National Reference Laboratory (The Norwegian Veterinary Institute).

## Results and discussion

### Live animals

#### Poultry

Altogether 9,160 faecal samples (boot swabs) with or without specimen of dust (cloths) from 1,312 different holdings were examined (Table 2). Two layer flocks were positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.1% (95% CI: 0.01% - 0.37%). Figure 1 shows the occurrence of *Salmonella* in poultry flocks from the implementation of the programme in 1996.

Table 2: Number of samples from poultry examined in the *Salmonella* surveillance programme in 2023.

Type of production	No. of holdings	No. of flocks	No. of samples	No. of positive <sup>3</sup>	<i>Salmonella</i> serovar
<b>Grandparents<sup>1</sup></b>					
Layers	2	2	26	0	
<b>Parents<sup>1</sup></b>					
Layers	7	15	88	0	
Broilers	93	235	1,683	0	
Turkey	3	12	126	0	
Ducks and geese	3	11	105	0	
<b>Total breeders</b>	<b>108</b>	<b>275</b>	<b>2,028</b>	<b>0</b>	
<b>Egg production</b>					
Pullets	12	121	170	0	
Layers	581	863	1,929	2	<i>S. Typhimurium</i> ; <i>S. enterica</i> subsp. <i>diarizonae</i> serovar 61:k:1,5,7
<b>Meat production</b>					
Broilers	556	4,576 <sup>2</sup>	4,576	0	
Turkey	42	286 <sup>2</sup>	286	0	
Ducks and geese	13	171 <sup>2</sup>	171	0	
<b>Total non breeders</b>	<b>1,204</b>	<b>6,017</b>	<b>7,132</b>	<b>0</b>	
<b>Total</b>	<b>1,312</b>	<b>6,292</b>	<b>9,160</b>	<b>2</b>	

<sup>1</sup> Include rearing- and adult flocks

<sup>2</sup> Number of slaughter batches

<sup>3</sup> Number of positive flocks



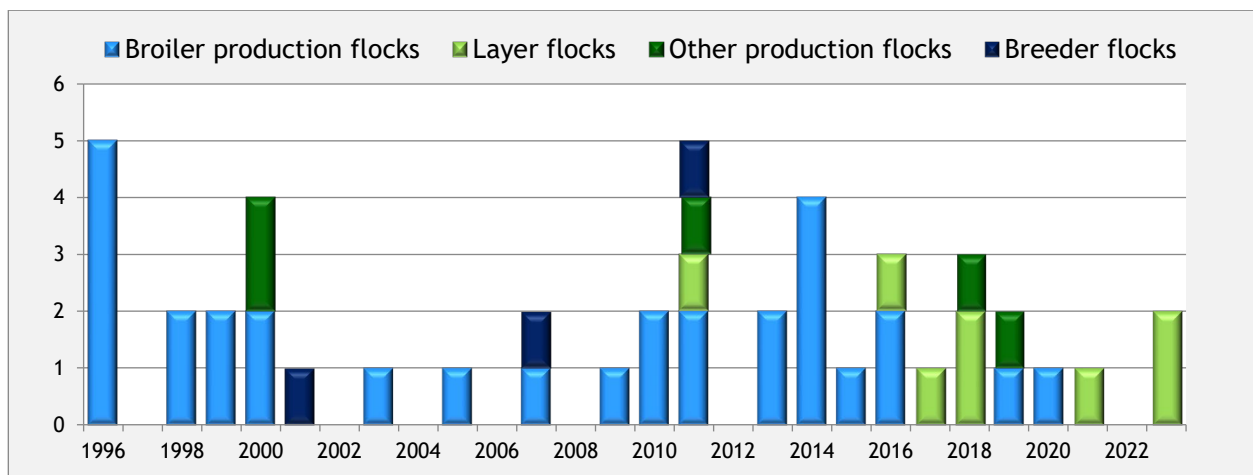


Figure 1: Number of positive poultry flocks found in the Salmonella surveillance programme since the start in 1996.

### Swine

Altogether 1,349 faecal samples from 69 elite and multiplier breeding herds were examined. *Salmonella* was not detected.

A total of 3,002 lymph node samples from pigs were examined (Table 3). Approximately 45% of the samples were taken from sows and the remaining from slaughter pigs. One sample from sow was positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.03% (95% CI: 0.001% - 0.19%) at the individual carcass level. Figure 2 shows the occurrence of *Salmonella* in samples from swine since the start of the programme.

### Cattle

A total of 3,172 lymph node samples from cattle were examined (Table 3). Three samples were positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.09% (95% CI: 0.02% - 0.28%) at the individual carcass level. Figure 2 shows the occurrence of *Salmonella* in samples from cattle since the start of the programme.

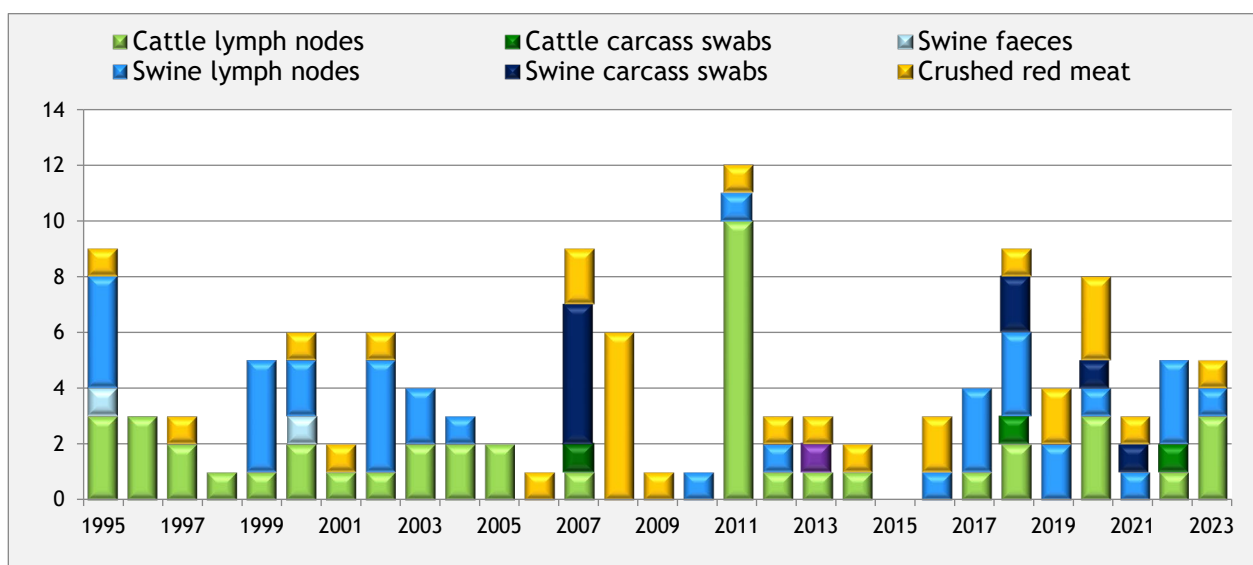


Figure 2: Number of positive faeces samples, lymph nodes, carcass swabs and crushed meat samples from cattle and swine found in the Salmonella surveillance programme since the start in 1995.

## Fresh meat

### Swab samples from cattle and swine carcasses

A total of 6,036 swab samples were examined (Table 3). *Salmonella* was not detected.

### Cutting plants for fresh meat

A total of 3,098 samples of crushed meat were examined (Table 3). One samples was positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.03% (95% CI: 0.001% - 0.18%) at sample level.

Figure 2 shows the occurrence of *Salmonella* in swab samples and samples from crushed meat since the start of the programme.

*Table 3: Number of individual lymph nodes, carcass swabs and crushed meat samples examined in the Salmonella surveillance programme in 2023.*

Species	No. of samples examined	No. of positive samples	<i>Salmonella</i> serovar
<b>Lymph node samples</b>			
Sows	1,329	1	<i>S. Saintpaul</i>
Slaughter pigs	1,673	0	
Cattle	3,176	3	<i>S. Hessarek</i>
<b>Swab samples from carcass</b>			
Sows	1,290	0	
Slaughter pigs	1,679	0	
Cattle	3,067	0	
<b>Crushed meat samples</b>	3,098	1	<i>S. enterica</i> subsp. <i>diarizonae</i> serovar 61:k:1,5,7

Lymph node samples from three cattle herds and one swine herd tested positive in 2023. All herds were followed up by the Norwegian Food Safety Authority by sampling of faeces from all animals, feed and the environment in the farms. Only samples from the swine herds were positive.

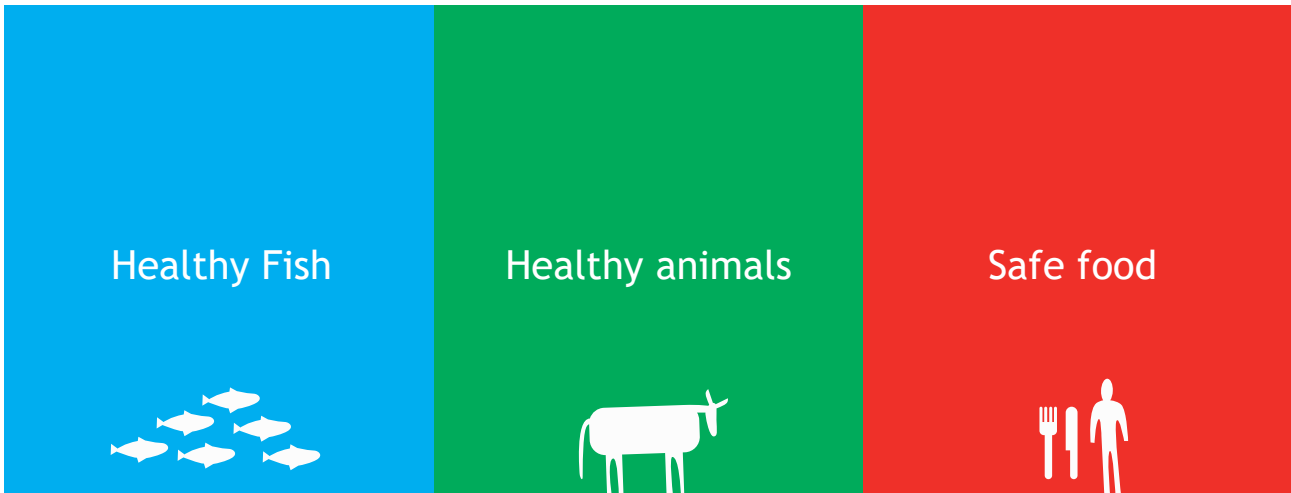
In conclusion, the results from the *Salmonella* surveillance programmes in 2023 are in agreement with previous years that the Norwegian cattle, swine and poultry populations are only sporadically infected with *Salmonella*. The estimated prevalence has been below 0.5% in the examined populations for all years the surveillance programmes have run.

## Acknowledgement

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