

SALMONELLA

INFORMATION AND GUIDANCE

2019



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1. Key salmonella Information

Common sources	Poultry, beef, pork, eggs, milk and vegetables
Transmission mode	Ingestion of contaminated food or water. Person-to-person transmission can also occur.
Occurrence	All age groups are affected by salmonella however infection rates are high in 0-4 age group.
Reservoir	Wild and domestic animals, birds and exotic pets. Also humans
Incidence of disease in Scotland	On average 800 cases (NTS ¹) cases reported per year
Symptoms	Nausea, vomiting, abdominal cramps, diarrhoea, fever, headache
Time between catching an infection and symptoms appearing (incubation period)	6 to 72 hours
Duration of illness	4 to 7 days
Infectious period	<ul style="list-style-type: none"> • The period of transmissibility extends throughout the course of infection/carriage and is greatest when the case is symptomatic. • Some people to carry salmonella bacteria in the bowel for long time, especially in young children; potentially lasting many months
Prevention tips	<ul style="list-style-type: none"> • Practice proper hand hygiene • Rinse raw products (salads or raw sprouts etc) thoroughly under running tap • Thoroughly cook meat and meat products • Use separate cutting boards/knives/tongs for raw meat and foods that are ready to eat • Keep raw meat, poultry and seafood away from other foods • Avoid eating raw eggs if they are not from the British Lion (or equivalent) scheme

¹ non-typhoid Salmonella

2. Salmonella

Salmonella infection (salmonellosis) is the second most commonly reported cause of bacterial infectious intestinal disease in Scotland after campylobacter.

Salmonella is a motile, non-spore forming, Gram-negative, rod-shaped bacterium in family *Enterobacteriaceae*².

Based on the clinical patterns in human salmonellosis, salmonella strains can be grouped into typhoidal salmonella and non-typhoidal salmonella (NTS)³. Typhoidal salmonella strains (*S. Typhi* and *S. Paratyphi*) are human host-restricted organisms that cause typhoid fever⁴. Salmonella strains other than *S. Typhi* and *S. Paratyphi* are referred to as NTS, and they infect or colonize a broad range of vertebrate animals or may be adapted or restricted to particular non-human animal species⁵. NTS infections are characterized by gastroenteritis, an inflammatory condition of the gastrointestinal tract which is accompanied by symptoms such as vomiting, diarrhoea, nausea, headache, abdominal cramps⁶. Typhoidal salmonella is common in the developing countries whereas NTS salmonellosis occur worldwide⁷.

The genus salmonella is classified into two species, *Salmonella enterica* and *Salmonella bongori*. *Salmonella enterica* is found predominantly in mammals and contributes approximately 99% of salmonella infections in human and warm-blooded animals therefore an important agent of foodborne illness⁸. Whereas *Salmonella bongori* is found mainly in the environment and also in cold blooded animals, therefore they are rare in humans⁹.

Within the genus *Salmonella enterica*, around 2600 serovars have been identified and most of these serovars have the ability to adapt within a variety of animal hosts, including humans¹⁰. NTS such as *Salmonella* Typhimurium and *Salmonella* Enteritidis are the most frequently isolated serotypes in humans in the UK¹¹.

Most salmonella infections occur after eating contaminated food or after contact with another person or animal with the infection.

² Barlow M and Hall BG. 2002. *Antimicrob Agents Chemother.* **46**:1190-1198.

³ Crump JA. *et al.* 2015. *Clin Microbiol Rev.* **28**: 901-937.

⁴ Connor DA and Schwartz E. 2005. *The Lancet Infect Diseases.* **5**:623-628.

⁵ Feasey NA. *et al.* 2012. *Lancet.* **379**:2489-2499.

⁶ Hohmann EL. 2001. *Clin Infect Disease.* **15**:263-269.

⁷ Gal-Mor O. *et al.* 2014. *Front Microbiol.* **5**:391-400.

⁸ Eug S-K *et al.* 2015. *J Frontiers in Life Sci.* **8**: 284-293.

⁹ Brenner *et al.* 2000. *J Clin Microbiol.* **38**:2465-2467

¹⁰ Allerberger *et al.* 2003. *Wien Med Wochenschr.* **153**:148-152.

¹¹ Plummer RA *et al.* 1995. *J Food Prot.* **58**:843-846.

3. Growth and survival characteristics

Salmonella spp. are not particularly heat resistant and most serotypes are killed by 60°C.

Table 1. Growth and survival limits

Parameter	Growth optimum	Growth range
Temperature (°C)	35 to 43	5 to 46
Water activity (a _w)	0.99	0.94 to >0.99
pH	7 to 7.5	3.8 to 9.5

(FSAI, 2011)

4. Sources and routes of transmission

Salmonella bacteria are widely distributed in domestic and wild animals. They are prevalent in food animals such as poultry, pigs, and cattle; and in pets, including dogs, cats, birds and reptiles such as turtles. Salmonella infection in humans is generally contracted through the consumption of contaminated food of animal origin, the consumption of raw or undercooked eggs (especially with non-lion marks on the eggs) or poultry are recognised to be a major importance¹². Person-to-person transmission can also occur through the faecal-oral route.

5. Human disease symptoms

Symptoms of salmonella vary depending on the type of salmonella that caused the infection. Symptoms usually appear 6 to 72 hours after the ingestion of contaminated food.

NTS infections are the most common salmonella infection worldwide. NTS infections symptoms, which cause self-limited illness, are gastroenteritis-like and include abdominal cramps, diarrhoea and nausea¹³. This infection usually lasts 4-7 days and is not life-threatening. However, in certain people (especially children aged under 5, older adults, pregnant women and people with weakened immune systems) the development of complications can be dangerous.

Typhoid salmonella infection symptom is typhoid fever, caused by *Salmonella typhi* and *Salmonella paratyphi*, and these infections are associated with a high morbidity and mortality rate and occur predominantly in developing countries¹⁴.

Human disease incidence

In 2016, 836 cases of total non-typhoidal salmonella from people in Scotland were reported - an increase of around 4% on the 803 reported in 2015. There were 362 reports of *Salmonella* Enteritidis in 2016 compared to 315 in 2015. Reports of

¹² Lake IR. 2017. *Environ Health*. **16**:117-124.

¹³ Gordon MA. 2008. *J Infect*. **56**:413-422.

¹⁴ Hardy A. 2004. *Postgrad Med J*. **80**:541-545.

Salmonella Typhimurium decreased slightly with 128 reports compared to 133 reports in 2015. Some other common serotypes are *S. Infantis*, *S. Virchow*, *S. Derby* or *S. Agona* but in much fewer numbers than *S. Enteritidis* or *S. Typhimurium*.

Overall, the rate of salmonella infection in Scotland was 15.6 per 100,000 population, a slight increase on the rate observed in 2015 (15.0 per 100,000 population).

HPS publish updated annual summary of salmonella data and can be accessed by this link: <http://www.hps.scot.nhs.uk/ewr/article.aspx>

6. Foodborne outbreaks

In 2016, there were two outbreaks of salmonella reported in Scotland. This is slightly lower compares with five outbreaks in 2015 and three in 2014. Both the outbreaks in 2016 were of *S. Enteritidis* and in both the suspected vehicle of transmission was eggs.

7. Legislation

The safety of foodstuffs is ensured by a preventative approach, i.e. the implementation of a food safety management system based on the principles of Hazard Analysis and Critical Control Point (HACCP).

Regulation (EC) No 2073/2005 on microbiological criteria in foodstuffs lay down salmonella food safety criteria and process hygiene criteria. These should be monitored by the individual food business operator in the context of their own HACCP programmes. The Regulation (EC) No 852/2004 on the hygiene of foodstuffs stipulates that FBOs must comply with microbiological criteria for foodstuffs, which is set down in Regulation (EC) No 2073/2005. Furthermore, Regulation (EC) No 853/2004 provides a possibility to lay down additional health standards for food of animal origin.

Links to relevant regulation:

- Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs - <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02005R2073-20170101>
- Regulation (EC) No 852/2004 on the hygiene of foodstuffs - <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02004R0852-20090420>
- Regulation (EC) No 853/2004 laying down specific hygiene rules for food of animal origin – <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1503913655953&uri=CELEX:02004R0853-20160401>

8. Control in the food chain

Data from outbreaks of foodborne diseases suggest that low numbers of *Salmonella* spp. can cause illness (e.g. ingestion of as few as 10—45 cells)¹⁵. Therefore, it is important that control measures are taken at all stages in the food chain. Examples of control measures include:

- Implementation of Good Hygiene Practices (GHP) and Good Manufacturing Practices (GMP) at all stages in the food chain.
- Implementation of a food safety management system based on the principles of HACCP, e.g. temperature control, good process control.
- Testing against microbiological criteria and other hygiene control measures.

Key factors that food handlers should be aware of, whether in a domestic or commercial kitchen, are:

- adherence to 'use by' dates
- provide advice to vulnerable groups on foods that they should avoid (such as non-Lion marked eggs, undercooked pork meats etc)
- wash hands thoroughly and frequently using soap and warm water
- ensure food is cooked thoroughly as this will kill any bacteria present (cook until it reaches an internal temperature of 75°C)
- keep kitchen areas clean

9. Relevant guidance

- Guidance on the practical implementation of the EC Regulation on microbiological criteria for foodstuffs
https://www.chilledfood.org/wp-content/uploads/2015/07/BRC_CFA_Micro_Criteria_Guidance_Ed_1.2.pdf
- Guidelines for assessing microbiological safety of R-T-E foods placed on the market
<https://www.gov.uk/government/publications/ready-to-eat-foods-microbiological-safety-assessment-guidelines>

¹⁵ Kisluk G and Yaron S. 2012. *Appl Environ Microbiol.* **78**:4030-4036.

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