Salmonella control at the source

SUMMARY NOTES

- Salmonella is an important cause of foodborne disease in humans throughout the world and is a significant cause of morbidity, mortality and economic loss.
- The application of good agricultural practices (GAP), good hygienic practices (GHP) and the Hazard Analysis and Critical Control Point (HACCP) system through out the production, slaughter, and processing steps is vital for the prevention of Salmonella and other foodborne diseases.
- The Codex Committee on Food Hygiene (CCFH) is developing guidance that will allow national governments develop and implement risk-based Salmonella control programmes. Guidelines developed by OIE will add to this work.
- Intersectoral collaboration, including the veterinary, food and public health sectors is needed to effectively address the prevention of foodborne zoonotic diseases.

This INFOSAN note describes an outbreak of Salmonella infection in poultry in Sweden, which was controlled by stamping out of the infected flocks using a “farm-to-fork” perspective, controlling as close to the source as possible.

Introduction

Salmonella spp. are zoonotic bacteria with birds as one of the reservoirs. The most important route of transmission is faecal-oral; humans can get infected through direct contact with infected individuals or indirectly through the consumption of contaminated food or water. The foodborne route appears to be the most common. The food categories posing the greatest risk to public health include raw meat, raw or undercooked products of poultry meat, eggs and products containing raw eggs. In addition, fruits and vegetables are becoming increasingly important sources of salmonellosis. A risk assessment conducted by FAO and WHO (FAO/WHO, 2002) noted that the human incidence of salmonellosis transmitted through eggs and poultry meat appeared to have a linear relationship to the observed Salmonella prevalence in poultry. This means that, when reducing the prevalence of Salmonella in poultry with 50% it is estimated that the incidence of salmonellosis in humans will fall with 50% assuming all other conditions stay constant.

There are more than 2000 different serovars of Salmonella, some of which are typically associated with certain animals or food types. Salmonella Enteritidis is a serovar typically linked to eggs, and to a lesser degree to poultry meat. It is a so-called invasive Salmonella, i.e. a serovar able to enter the bloodstream of the bird and infect the egg. Also Salmonella Typhimurium is often linked to eggs, but more commonly to poultry meat.

1 Stamping out: the killing of the animals which are affected and those suspected of being affected in the herd and, where appropriate, those in other herds which have been exposed to infection by direct or indirect contact of a kind likely to cause the transmission of the causal pathogen. See the website from the World Organisation for Animal Health (OIE) for more information: http://www.oie.int/eng/normes/mcode/en_chapitre_1_1_1.htm
Salmonella is an important cause of foodborne disease in humans throughout the world and is a significant cause of morbidity, mortality and economic loss. Salmonellosis ranks as one of the most frequently reported foodborne diseases worldwide.

**The structure of the poultry sector**

Large scale poultry production has a pyramid breeding structure with genetic selection at the top, amplification through the system down to breeder flocks and the production stage at the baseline. The grandparent flock will produce millions of offspring. Consequently, the presence of Salmonella in the grandparent flocks will result in a corresponding increase in the prevalence of Salmonella contaminated birds at the production stage.

Hence, stamping out infected grandparent and parent birds at the top of pyramid will have far-reaching limiting effects on the Salmonella burden at the production stage and ultimately on public health. In Denmark, conservative estimates from a cost benefit analysis comparing Salmonella control costs in the production sector with the overall public health costs of salmonellosis suggest that Salmonella control measures saved the Danish society US$ 14.1 million in the year 2001 (Wegener et al., 2003). This corresponds to approximately US$ 3 per capita. A Swedish cost benefit analysis from 1992 showed roughly the same figures. It is likely that these savings will increase in the future as the control costs will decrease over time.

**Salmonella control in poultry production in Sweden**

A baseline study on the prevalence of Salmonella in holdings of laying hen flocks conducted by the European Food Safety Authority (EFSA) revealed a Salmonella spp. prevalence of 30.8% ranging from a minimum of 0% (Luxembourg and Sweden) to a maximum of 79.5% (Portugal) (EFSA, 2007).

A recent outbreak in Sweden is an illustrative example of possible Salmonella control measures. The Swedish policy of Salmonella control in poultry is based on the principles of a comprehensive control throughout the farm to fork continuum, for example whenever Salmonella is found in poultry feed, or in poultry, the Salmonella contaminated feedstuffs and/or infected birds are removed from the food-chain (Wierup et al., 1995). Although currently under revision to include new EU regulations Table 1 shows the mandatory Salmonella sampling scheme in poultry.

### Table 1. Mandatory Salmonella sampling scheme in poultry. Total number of sampling occasions and (frequency of sampling occasions) in different categories of poultry.

<table>
<thead>
<tr>
<th>Category of poultry</th>
<th>Production period</th>
<th>Rearing</th>
<th>Egg-production</th>
<th>Hatchery</th>
<th>Sampling prior to slaughter</th>
<th>Slaughter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grandparents</td>
<td></td>
<td>5 a)</td>
<td>~ 10 b,c)</td>
<td>~ 20 b,d)</td>
<td>1</td>
<td>e)</td>
</tr>
<tr>
<td>Parents</td>
<td></td>
<td>3 a)</td>
<td>~ 10 b,c)</td>
<td>~ 20 b,d)</td>
<td>1</td>
<td>e)</td>
</tr>
<tr>
<td>Layers</td>
<td></td>
<td>1</td>
<td>3</td>
<td>n.r.</td>
<td>1</td>
<td>e)</td>
</tr>
<tr>
<td>Meat producing poultry</td>
<td></td>
<td>n.r.</td>
<td>n.r.</td>
<td>n.r.</td>
<td>1</td>
<td>e)</td>
</tr>
<tr>
<td>Ratites, breeders</td>
<td>4 sampling occasions per year</td>
<td>n.r.</td>
<td>n.r.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quails, egg producing</td>
<td></td>
<td>n.s.</td>
<td>2 sampling occasions per year</td>
<td>n.s.</td>
<td>n.s.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture, Food and Fisheries

- a Extended sampling compared to the zoonosis directive (92/117/EEC)
- b Sampling according to the zoonosis directive
- c One sampling per month
- d One sampling every second week
- e Monitoring at slaughter. Annually about 4000 neck skin samples are collected.
- f Broilers, turkeys, ducks, geese, ratites

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In December 2006, *Salmonella* Typhimurium phage type NST (no specific type) was isolated in two parent flocks in southern Sweden. The outbreak investigation identified the probable index case being an infected grandparent flock. The infection had spread to four parent flocks and five broiler flocks. It appears that that the grandparent flock, despite intensive sampling with negative results, had been infected 7-10 weeks before detection and during this time the infection was transmitted to 9 flocks.

All flocks were stamped out and the carcasses, eggs and feed sent for destruction. Cleaning and disinfection procedures were implemented. To date, the initial source of this Salmonella outbreak is unknown. No further spread of Salmonella infection was seen and there was no increase in Salmonella prevalence in poultry production flocks, in Swedish produced poultry meat or in human salmonellosis cases.

**Concluding remarks**

The total number of human salmonellosis cases in Sweden in 2006 was 4056 (44.9 per 100 000 pop. and year) of which 1010 were domestically acquired (25%)\(^3\). Almost all other Salmonella cases (2963, 73%) are imported cases. The relative small number of domestic cases supports the current Swedish Salmonella control measures.

Effective prevention strategies throughout the entire farm-to-fork continuum are the most efficient ways to produce safe food. FAO and WHO encourage countries to establish control programmes throughout the food-chain and to implement systems that allow the implementation of control measures at the point of the greatest efficiency, including in the primary production sector. A prerequisite for efficient Salmonella control as for any foodborne zoonotic disease is to ensure good and interactive intersectoral collaboration, among the veterinary, food and public health sectors at all levels: local, national and international. A good example of the latter is the OIE working group on Animal Production Food Safety of which both FAO and WHO are members.

The OIE Ad-hoc group for salmonellosis has developed guidelines for the detection, control and prevention of *Salmonella* Enteritidis and *Salmonella* Typhimurium in poultry producing eggs for human consumption. Complementary to this, a newly established CCFH working group on management of Salmonella and Campylobacter in poultry will develop guidance to assist national governments develop and implement risk-based Salmonella control programmes. WHO and FAO will provide input into this process.

**Additional guidance on Salmonella**

Descriptions of activities, reports, news and events related to Salmonella can be found at: [http://www.who.int/topics/salmonella/en/index.html](http://www.who.int/topics/salmonella/en/index.html)

More information on the WHO and FAO international risk assessment work on Salmonella in eggs and broiler chickens can be found at: [http://www.who.int/foodsafety/micro/jemra/assessment/salmonella/en/](http://www.who.int/foodsafety/micro/jemra/assessment/salmonella/en/)

**References:**


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\(^3\) For more information see the website of the Swedish Institute of Infectious diseases: [http://www.smittskyddsinstitutet.se/in-english/statistics/salmonellosis/](http://www.smittskyddsinstitutet.se/in-english/statistics/salmonellosis/)

INFOSAN serves as a vehicle for food safety authorities and other relevant agencies to exchange food safety information and to improve collaboration among food safety authorities at both the national and international level.

INFOSAN Emergency, embedded in INFOSAN, links official national contact points to address outbreaks and emergencies of international importance and allows for the rapid exchange of information. INFOSAN Emergency is intended to complement and support the existing WHO Global Outbreak Alert and Response Network (GOARN).

INFOSAN is operated/managed by WHO, Geneva. It currently includes 154 Member States.

More information is available at: [www.who.int/foodsafety](http://www.who.int/foodsafety)