

ZOONOTIC PATHOGENS

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The successful control of *Salmonella* in pigs in Norway

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Introduction

The occurrence of *Salmonella* in domestic animals is in many countries considered the normality, and especially grain-based industrial production of pigs is linked to high levels of infections and corresponding common transfer to humans through the food chain (Davies et al., 2004). However, despite the fact that latent *Salmonella* infections were a problem in pigs thirty to forty years ago, Norwegian pig herds are virtually free from *Salmonella* today. Although the biology of *Salmonella* has been well known for decades, reports of the practical and efficient intervention of *Salmonella* in pig herds implemented at the national or regional level are rare. This paper demonstrates the unique and favourable situation which Norway shares with Finland and Sweden, in a global market with a significant *Salmonella* problem.

Materials and Methods

The data sources used in this paper consisted of:

- A compilation of historical data
- Data from the systematic Norwegian *Salmonella* Surveillance and Control programme (NSSCP)
- Data from serological testing presented in scientific reports
- Reported human cases caused by *Salmonella* based on the Norwegian Surveillance System for Communicable Diseases (MSIS).

Results

- Documentation from the 1950s up to the 1970s showed common latent *Salmonella* infections in Norwegian pig herds. As one example, Bøvre (1957) investigated ileocaecal lymph nodes from 4114 pigs reduced into 436 pooled samples, and *Salmonella* was isolated from 45 (10.3%) of the pooled samples and 27 (13.4%) of 202 herds. *S. Typhimurium* was isolated from 16 of the herds. In the early 1970s, Ween (1972) investigated ileocaecal lymph nodes from 540 pigs reduced into 54 pooled samples. *Salmonella* was isolated from 12 (22.2%). *S. Typhimurium* was isolated from 7 of the pooled samples. Two of the isolates were further characterized as variant Copenhagen.

- The number of positive faecal samples, lymph nodes, carcass swabs isolated in NSSCP since the start in 1995 has remained very low (below 0.1%) throughout the period, and *S. Typhimurium* dominants among the few isolates
- In the serological survey of serum from 2424 pigs representing 66 herds, 22 (0.9%) pigs were positive when a cutoff level of OD (Optical Density)% = 30 was used in the ELISA. The positive samples were distributed among 11 herds. A comparison between traditional microbiological and serological testing was carried out in the survey of 1915 samples randomly selected from 18 slaughterhouses (Lium et al., 1998). The average OD% for the whole material was 1.1. *S. Typhimurium* was isolated from lymph nodes in two pigs
- Most cases of human salmonellosis in Norway (70-80%) are due to infection abroad, except *S. Typhimurium*, where about half of the cases are infected in Norway. Salmonellosis occurs most frequently during the summer, mainly due to increased travel activity during this period. Also, single domestic cases and outbreaks are often caused by imported foods.

Discussion and Conclusion

The fact that two historical articles within this topic had titles like “Latent *Salmonella* infection in slaughter animals in Norway” (Bøvre, 1957) and “Latent *Salmonella* infection in fattening pigs” (Ween, 1972), tells that the results were not considered arbitrary or unusual. There were, in other words, certain considerable problems related to *Salmonella* some decades ago in Norwegian pigs.

After implementing measures at herd level, *Salmonella* in farm animals hardly poses any risk for the meat industry and the human population of Norway today. It may be argued that the Norwegian success is linked to a husbandry structure with limited animal density. However, Rogaland (Jæren) in Norway represents one of the regions with the highest density of livestock in Europe. Climate and temperature may be limiting the spread and persistence of *Salmonella* in our pig production and environment. Our pig population has further been separated from pigs from other countries through an industry-driven system to limit the import of live animals.

S. Typhimurium is the most common *Salmonella* in pig herds in most countries, and this agent is known to be introduced into the herds by healthy carriers among the breeding animals and also by contaminated feed (Davies et al., 2004). Other types than *S. Typhimurium* are introduced by feed, and the most

common types do not survive in the environment. Strict biosecurity linked to imported feed, may also hinder the introduction in the pig production. There is an extensive list of additional risk factors connected to biosecurity that should be taken care of at herd level such as birds, rodents, insects, water, humans entering the piggery and environment (manure etc.).

In Norway, the traditional co-operation between the farmers, abattoirs and the food safety authority through many decades is also essential. The food safety authority follows up positive herds by preventing transmission to other herds, humans and food by prohibiting the purchase and transportation of animals and foods from infected farms. The food safety authority also demands sampling until the herd is documented free from *Salmonella*, and also sampling of herds which have been in contact with the infected herd.

We have experienced and accordingly support the view that starting with breeding animals free from *Salmonella* at the top of the breeding pyramid have been the most important measures. We do not believe that any country has to live with a high level of *Salmonella* infections in their pigs, but control of this agent is a continuous effort and the main elements linked to biosecurity, population management and feed control need to be focused all the time. There are other ways to achieve nearly *Salmonella*-free pig carcasses such as good slaughter hygiene and decontamination. A study by Goldbach & Alban (2006), suggests that post-harvest interventions such as hot-water decontamination seem to be more cost-efficient than a pre-harvest strategy for *Salmonella* in pork in Denmark. However, this issue is also linked to a sustainable and “clean” pig production from farm to fork also solving the general problems connected to the environment and willingness to work over many years to achieve this goal. The Norwegian experience and success story, together with similar stories from Sweden and Finland, is a good illustration of this issue.

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