No outbreaks of Salmonella among humans traced back to Swedish pork during 1996 and 1997

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Introduction

In Sweden all Salmonella strains isolated from animals have to be reported as well as all human cases of salmonellosis. All isolates are subjected to serotyping and for S. Typhimurium and S. Enteritidis phage typing is done. Since 1995 continuous monitoring programmes aimed at documenting the prevalence of Salmonella are in force (2). Prevalence in herds, slaughterhouses and cutting plants has been documented during the last four years and the overall prevalence has been proven to be less than 0.1%, 95% confidence interval (3-6). In this study Salmonella findings reported during a two-year period, 1996 and 1997, has been revised in detail in order to reveal connections of human cases related to pork.

Materials and Methods

The Swedish Board of Agriculture provided official figures for Salmonella isolated in pig herds. A total of four herds were reported during the two-year period. The serotypes isolated were S. Derby, S. Cubana and S. Java (table 1). The herds had been identified on different levels of the control program, either through faecal sampling, from sanitary slaughter or from the slaughterhouse survey. The Swedish Institute for Infectious Disease Control provided official figures for Salmonella isolated from humans. A total of 8147 cases were reported during the study period, 14% of these cases were domestic cases (5-6). Important sources for domestically acquired infections during the study period were secondary cases to imported cases, reptiles, wild birds, imported/private-imported food.

All human domestic cases with the same serotypes as those found in the pig herds were recorded. Records kept on investigations done in purpose to trace the infection source were revised. Information gathered was whether infection sources had been established, in particular if any associations with pork had been found.

Official figures on occurrence of Salmonella types isolated from different animals and other sources were used to estimate the relevance of pork as the source of infection.

Results

For the three serotypes identified from pig farms, 29 human domestic cases were found during 1996-1997, in 11 of these cases the source of infection was established.

Infection acquired from persons infected abroad was evident in 21% of the cases and 17% of the infections came from turtles and snakes. For S. Cubana, no human domestic cases were identified. Left to explain was 14 cases of S. Java and 5 cases of S. derby.

Table 1) No. of pig farms found infected by salmonella in 1996 and 1997 and no. of corresponding human cases under the same period

<table>
<thead>
<tr>
<th>Serotype</th>
<th>no. of herds infected</th>
<th>no. of humans infected</th>
<th>source of human infections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derby</td>
<td>2</td>
<td>7</td>
<td>2 sec.*</td>
</tr>
<tr>
<td>Cubana</td>
<td>1</td>
<td>1</td>
<td>1 sec.</td>
</tr>
<tr>
<td>Java</td>
<td>1</td>
<td>21</td>
<td>3 sec., 4 turtle, 1 snake, 1 farmer</td>
</tr>
</tbody>
</table>

* Secondary case to person infected abroad

A primary host for S. Java is turtles (1). S. Java can otherwise be found in a broad range of animals but have not been reported from swine in Sweden since at least 1949, when reporting systems started (12). The disease history from the case farm revealed that the most probable infection route was from the farmer to the pigs.

For S. Derby, pigs are a well known host. The remainder of the human cases that may be attributable to consumption of Swedish pigmeat is 5 cases in 2 years. In a report to the European commission from 1997, results from a random sampling done in 1997 is described (8). It was reported that 12% of imported consignments of beef and pork certified free from Salmonella did contain Salmonella. S. Derby has been reported from this study and several times from other imported consignments (prevalence figures not known). The prevalence of Salmonella calculated from the total number of

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samples taken from imported consignments of pork was 4% (5/140). From a total of 1419 samples collected in purpose to reflect the Salmonella prevalence in Swedish pork and beef, only one (0.009%) isolate of Salmonella has been found through the years 1996 and 1997 (13). Approximately 10% of consigned pork is imported, the chance of buying Salmonella contaminated pork was approximately 400 times greater for imported meat, as compared to Swedish meat, during the study period.

If looking at reported figures for humans as being ten fold under reported, human shedsders of Salmonella are calculated to be at least 40 times more common than pigs shedding Salmonella. The risk of pigs contracting Salmonella infections from humans might thereby be more likely than the risk of humans being infected from pigs.

Comparison between animal and human isolates of Salmonella during 1996 and 1997 yielded no proof of human Salmonella outbreaks originating from Swedish swine, when epidemiological investigations of human cases where revised.

Discussion

The last ten years the number of Salmonella outbreaks in Swedish pig farms has been restricted to 0-5 herds/year (13). Results from this study also confirms that Swedish pork has an insignificant impact on human salmonellosis. The successful control of Salmonella in Swedish pig herds may depend on several different factors. All factors are not known but factors specific for Sweden compared to most other countries can be mentioned. Laws and regulations on Salmonella control have been in place since 1961. Both herds and feedmills are included in the control.

One factors associated with hygiene on the farms is that a large proportion of the piglet producing farms, approximately 60%, sell all growers to specialised herds for slaughter swine production. Integrated farms usually have less strict batch production, as compared to specialised slaughter pig herds.

Other important factors can be traced back to the existence of regulations in animal welfare, which have a long tradition. Adverse effects on animal health and welfare from applying "high productivity" methods for animal husbandry were recognised early. Regulations adopted in 1973 intended to ensure that new systems in livestock production should be proven safe and not to have adverse effects on animal health and welfare (9). Examples of animal welfare regulations for slaughter pigs include access to straw, slatted floors only being permitted in the dung area, enough space for all pigs to eat and lie down simultaneously. The poor environment provided for pigs on slatted floors with no straw provided has been shown to cause behaviour disturbances such as cannibalism and chewing on inappropriate objects (10). Apart from speculating on environmental stress and infection susceptibility, chewing on fittings exposed to manure can be predicted enhance Salmonella spread on a farm. Another drawback with slatted floors is that residuals of manure can be a problem since cleaning is less easy.

To practice tail docking and hereby mask increased levels of environmental stress has never been permitted in Sweden. To find, and reduce, stress factors in cases of tail biting is an important task for both veterinarians and farmers. Several reports have described tail docking as a significant risk factor for enteric diseases (11), stress factors has been discussed as an underlying cause.

The fact that antimicrobial growth promoters have been banned since 1986 could also contribute to the low prevalence of Salmonella in pig herds. Several antimicrobial growth promoters have the same dosage interval as the substance has for clinical use in swine (7), in conclusion a substantial impact on the intestinal microflora can be expected. One negative effect expected in respect of Salmonella spread is if the antimicrobial substance used has an inhibitory effect on microflora regarded as protective, such as lactic acid bacteria, and/or change the microbial ecology in the gut towards a gram negative spectrum of bacteria. In fact, by comparing the number of positive herds from 1971 to 1991 (12) salmonella outbreaks were significantly higher when antibiotic policy in animal production was less restrictive. There are also hygienic considerations with antimicrobial growth promoters. A less clean environment in combination with antimicrobial growth promoters can be used to reach the same productivity as in a clean environment (7).

Factors influencing environmental microbiology, the microbiology of the gut and the resistance against enteric pathogens can not be demonstrated in a static model with single risk factors. Threshold effects for Salmonella spread, when a sufficient number of negative factors act simultaneously, can be expected and the dynamic character among different factors have to be taken into consideration.

Salmonella types interacting with the immune system, like S. Typhimurium can be expected to respond to factors affecting disease resistance. S. Typhimurium in pig herds has to our experience not been shown to be a major problem, herds have been cleared from infections quite rapidly. The salmonella spread of serotypes that are more adapted to pigs and apparently less immunogenic, like S. Derby, appear more difficult to control.

In conclusion, outbreaks of Salmonella among humans could not be proven to originate from Swedish pig meat during 1996 to 1997, and hereby no costs of illness in humans due to Swedish pork could be demonstrated. Part of an approach to control Salmonella in pigs, which would pay back to the human society could be animal welfare programs aiming at providing animals a clean and animal friendly environment.
References


