Epidemiology of *Salmonella* infections in sow herds in the Czech Republic

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Abstract

*Salmonella* prevalence was assessed in six herds of sows by serological ELISA test and faecal culture. Blood and faecal samples were collected, prior to weaning of piglets, from 45 sows housed in separated pens in each group of a herd. Increased levels of specific antibodies were found in all six herds. Serologically positive samples averaged 41.85%. Faecal shedding of *Salmonella* from the carriers was found in four herds with the average of 7.8%. *Salmonella* prevalence, as assessed by serological testing and faecal culture, was 17.8% and 13.3% in herd I, 20.0% and 4.4% in herd II, 40.0% and 20.0% in herd III, 53.3% and 0% in herd IV, 86.7% and 8.9% in herd V, and 30.3% and 0% in herd VI. A total of 21 *Salmonella* spp. strains were isolated which were classified into the serotype Derby (n=17), London (n=2), Bredeney (n=1), and Goldcoast (n=1). All isolates were sensitive to the antibiotics used. No correlation was found between *Salmonella* seroprevalence in ELISA test and positive faecal culture in the examined herds of sows. The result of faecal culture was negative in two sow herds with high seroprevalence. Serological ELISA test is an efficient diagnostic tool for *Salmonella* detection in suspected herds. The results of our study showed association between the incidence of S. Derby in sows and slaughtered fattening pigs originated from the same farrow-to-finish herds.

Introduction

Swine herds are sources of human salmonellosis which is a very frequent alimentary disease in many countries. As a public health concern and food safety throughout the whole production chain, the European Commission has issued new legislations on monitoring and control of zoonoses and their causative agents (Anonymous, 2003). *Salmonella* infections in pigs are in most European countries including the Czech Republic predominantly caused by the serotype Typhimurium and Derby and occur very frequently in an asymptomatic form. No clinical symptoms can be seen in pigs following the infection; however, some of the pigs become permanent *Salmonella* carriers. Thus, a latent infection exists in a herd, which is difficult to detect due to intermittent *Salmonella* shedding via faeces. Therefore serological diagnosis of *Salmonella* infections in pigs has been introduced, using ELISA test (Nielsen et al., 1995) whose sensitivity and specificity was harmonised with the international standards (Van der Heijden, 2001). The carriers play an important role in *Salmonella* transmission. These are especially sows of the basic (breeding) herd or newly purchased animals which persistently shed *Salmonella* in faeces and thus keep the infection in a herd (Kranker et al., 2001). The objective of our study was to assess *Salmonella* prevalence by serological ELISA test and faecal culture in sow herds and evaluate the risk of *Salmonella* transmission to progeny.

Material and methods

Six herds of sows housed in the farrowing units were examined by serological ELISA test and cultivation over the period October 2005 – June 2006. *Salmonellas* were isolated from caecum contents and mesenteric lymph nodes (MLN) in slaughtered fattening pigs from four farrow-to-finish herds. S. Typhimurium, S. Derby and S. Infantis were isolated from sows of herd I, S. Typhimurium and S. Derby were isolated from herd II, III and IV. In these herds *Salmonella* seroprevalence ranged from 20 to 40%. Forty-five specimens of blood and faeces were collected from each farrowing unit prior to weaning of piglets. Serum samples were examined by the
Svanovir® Salmonella Covalent Mix-ELISA (Svanova, Sweden) kit and evaluated according to the manufacturer's instructions. Fresh faecal samples of 10g were collected from floor in individual pens and cultured using the method EN ISO 6579:2002 for Salmonella isolation. The isolated strains were typed with agglutination O and H antisera and classified into serotypes according to the Kaufmann-White scheme. After serotyping, the isolated strains were examined by the disc diffusion method (NCCLS, 2002) for sensitivity to antibiotics. The following antibiotics were used: Ampicillin (AMP 10 μg), Amoxycillin/Clavulanic acid (AMC 30 μg), Apramycin (APR 15 μg), Colistin (CT 10 μg), Sulphamethoxazole/Trimethoprim (SXT 25μg), Cefotaxime (CTX 30 μg), Enrofloxacin (ENR 5 μg), Gentamicin (CN 10 μg), Neomycin (N 30 μg), Streptomycin (S 10 μg), Tetracycline (TE 30 μg), Chloramphenicol (C 30 μg), Nalidixic acid (NA 30 μg), Sulfisoxazole (Su 300 μg), Kanamycin (K 30 μg).

Results

Salmonella status of sow herds estimated by serology and culture is provided in Table 1. Samples of blood and faeces taken from a total of 270 sow originated from six farrow-to-finish herds were examined. Increased antibody levels were detected in all six herds. The average Salmonella seroprevalence was 41.85%. Salmonella excretion in faeces of carriers was demonstrated in four herds. The percentage of ELISA and culture positive faecal samples was 17.8% and 13.3% in herd I, 20.0% and 4.4% in herd II, 40.0% and 20.0% in herd III, 53.3% and 0% in herd IV, 86.7% and 8.9% in herd V, and 30.3% and 0% in herd VI. A total of 21 Salmonella spp. strains were isolated. The most frequent serotype was Derby (n=17) which was isolated from herd I (n=2), II (n=2), III (n=9) and V (n=2). The serotype London (n=2) was only isolated from herd I. In herd V, serotypes Bredeney (n=1) and Goldcoast (n=1) were further isolated. All the isolates were sensitive to the antibiotics used (not shown).

<table>
<thead>
<tr>
<th>Herd</th>
<th>ELISA</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of positive/Number of examined samples*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Salmonella serotypes</td>
</tr>
<tr>
<td>I</td>
<td>8/45 (17.8 %)</td>
<td>6/45 (13.3 %)</td>
</tr>
<tr>
<td>II</td>
<td>9/45 (20.0 %)</td>
<td>2/45 (4.4 %)</td>
</tr>
<tr>
<td>III</td>
<td>18/45 (40.0 %)</td>
<td>9/45 (20.0 %)</td>
</tr>
<tr>
<td>IV</td>
<td>24/45 (53.3 %)</td>
<td>0/45 (0 %)</td>
</tr>
<tr>
<td>V</td>
<td>39/45 (86.7 %)</td>
<td>4/45 (8.9 %)</td>
</tr>
<tr>
<td>VI</td>
<td>15/45 (33.3 %)</td>
<td>0/45 (0 %)</td>
</tr>
<tr>
<td>Total</td>
<td>113/270 (41.9 %)</td>
<td>21/270 (7.8 %)</td>
</tr>
</tbody>
</table>

*samples of blood and faeces

Figure 1 presents the comparison of Salmonella prevalence in sow herds as determined by serological ELISA test and faecal culture. No correlation was found between Salmonella seroprevalence tested by ELISA and positive faecal culture in sow herds under study. Negative faecal culture was found in herd IV and VI with high seroprevalence (53.3% and 30.3%).
Fig. 1 *Salmonella* prevalence in sow herds determined by serological ELISA test and faecal culture

![Graph showing *Salmonella* prevalence in sow herds](image)

**Discussion**

The results of our study confirmed the data from other countries showing that sows are an important link in the epidemiology of *Salmonella* infections in farrow-to-finish herds of swine. Sows, as *salmonella* carriers, are the source of infection for piglets and can contaminate the stable environment. Through weaned piglets from infected litters, *Salmonellas* are transmitted to fattening pigs in the production chain, which may further cause contamination of swine carcasses and the slaughter line (Kranker et al., 2003; Beloeil et al., 2004; Nollet et al., 2005). High *Salmonella* prevalence demonstrated in our study by serological ELISA test and faecal culture made evidence of a widespread infection in six herds under study. No correlation was found in our study between *Salmonella* seroprevalence in ELISA test and positive faecal culture (Funk et al., 2005). In herd I, II, III and V seroprevalence was markedly higher compared to positive faecal culture. In spite of a high seroprevalence (53.3% and 30.3%) found in herd IV and VI, no *Salmonellas* were isolated from faecal samples. We assume the result of faecal culture to be false negative, because S. Derby and S. Typhimurium were isolated from slaughtered fattening pigs originated from herd IV. The results of our study indicate an indirect association between S. Derby isolation from sows and the slaughtered fattening pigs in identical farrow-to-finish swine herds. The results further show that efficient control of *Salmonella* infections in farrow-to-finish herds of swine should start on sow level.

**Conclusions**

High *Salmonella* prevalence in the investigated sow herds as determined by serological ELISA test and faecal culture gave evidence of a widespread infection within the sow herds. No correlation was found between *Salmonella* seroprevalence in ELISA test and faecal culture. Active shedders of the prevalent *Salmonella* serotype Derby in infected sow herds presented a high risk of transmission of the infection to piglets. Based on isolation of the above serotype from sows and slaughtered fattening pigs originated from the same farrow-to-finish herds, indirect transmission of the infection is suggested. Intensive *Salmonella* surveillance using serology and culture methods is crucial to effective *Salmonella* control in farrow-to-finish swine herds.
Acknowledgement

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References


